

**Independent Oversight Review of the
Bonneville Power Administration
Safety Management Program**



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Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ACM	Asbestos-Containing Material
ADF	Agency Decision Framework
AIB	Accident Investigation Board
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute
APM	Accident Prevention Manual
BPA	Bonneville Power Administration
BPI	Bonneville Purchasing Instruction
CFR	Code of Federal Regulations
CMO	Contract Management Office
COTR	Contracting Officer's Technical Representative
CSHC	Central Safety and Health Committee
CY	Calendar Year
DART	Days Away, Restricted, or Transferred
DOE	U.S. Department of Energy
EFCOG	Energy Facility Contractors Group
FTE	Full Time Equivalent
FY	Fiscal Year
GHS	Global Harmonization Standards
HazCom	Hazard Communication
HPI	Human Performance Improvement
HSS	Office of Health, Safety and Security
J-1	J-1 Job Briefing Information Documentation
JHA	Job Hazards Analysis
MAD	Minimum Approach Distance
MPM	Medical Program Manager
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
PCS	Personal Communication System
PPE	Personal Protective Equipment
PTSA	Pre-Task Safety Analysis
QA	Quality Assurance
R2A2	Roles, Responsibilities, Authorities and Accountabilities
SDS	Safety Data Sheet
S&H	Safety and Health
SME	Subject Matter Expert
SSSP	Site Specific Safety Plan
TLV	Threshold Limit Value
TF	Transmission Field Services
TRC	Total Recordable Case

Executive Summary

The U.S. Department of Energy Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security, conducted an independent review of the Bonneville Power Administration (BPA) safety management program. BPA management requested that Independent Oversight conduct an independent review as one of several BPA initiatives to improve safety management in response to four fatalities that have occurred during BPA work activities since 2010, two of them in the second half of 2013. The review evaluated three overarching areas: (1) BPA safety and health management systems and processes as applied to BPA Federal workers and supplemental workers (i.e., contractor augmented staff), (2) safety and health processes applied to contracted work (typically construction-like projects and vegetation control performed by contractors), and (3) BPA performance assurance processes and practices.

Safety and Health Programs for BPA Work. BPA workers performed numerous work activities without incident, and the Independent Oversight team observed many work activities carried out safely by skilled individuals. BPA has also established a collection of documents that provide requirements, processes, and expectations for the safe conduct of work.

However, during work observations and facility walkthroughs, the Independent Oversight team observed or identified numerous examples and indications of unsafe or less-than-adequate conditions and practices at work sites (i.e., violations of Occupational Safety and Health Administration and/or BPA requirements). In most cases, controls were not implemented because workers lacked knowledge or clear understanding of controls; in a few cases, supervisors and workers did not follow established safety and health controls. These observations present vulnerabilities to the safety and health of the BPA workforce and reflect a BPA safety and health program that is not adequate to ensure that workers are trained and informed of hazards and controls for assigned work activities. The identified deficiencies in the BPA safety and health programs resulted, in part, from shortcomings in BPA management systems, including the lack of a requirements management system, the lack of a clear hierarchy of documents for safety and health management, gaps and deficiencies in safety and health programs and work instructions for their implementation (e.g., procedures or work planning and control processes), inadequate assignment of roles and responsibilities, and lack of a comprehensive training program that ensures individuals are competent to fulfill assigned roles and responsibilities processes. Improvements in BPA safety programs and associated management systems are an essential first step in eliminating the observed vulnerabilities and improving BPA performance in protecting worker safety and health.

Safety and Health Processes for Contracted Work. BPA has various processes for incorporating safety provisions in contracts, and some aspects of these processes are appropriately designed (e.g., use of pre-screened contractors). Recognizing the significant increase in contracted work in the past few years, BPA has taken some actions to enhance its ability to manage and oversee contractors (e.g., expanding the inspection force through supplemental labor). The Independent Oversight team observed many work activities carried out safely by skilled individuals using appropriate personal protective equipment.

However, the Independent Oversight team observed or identified evidence of some unsafe conditions and deficient practices at work sites, such as: walkways and paths had fall and trip hazards; a trench did not have ladders to provide for ready egress, and excavated spoils from the trench were too close to the trench, contrary to Occupational Safety and Health Administration (OSHA) requirements; cutting operations were performed with no hot work permit; and an open flame torch was used to heat a hydraulic tank without consideration of safe work and fire control practices. In addition, the Independent Oversight team observed numerous instances of hazard controls or processes that were required by the contract or applicable OSHA requirements but were not followed or were not effectively implemented. For example, hazard analyses are not regularly conducted at the task level, and the generic hazard analyses do not

sufficiently address all task specific hazards. These observed deficiencies in contractor practices at the work site often result from weaknesses in BPA contract management and performance assurance processes. For example, BPA processes do not ensure that contractors have a clear understanding of requirements that must be followed while performing work for BPA. Although BPA has ongoing initiatives to improve contract management processes, additional efforts that focus on safety requirements and oversight for contracted work will be essential in improving safety performance and correcting identified deficiencies.

Performance Assurance Systems. BPA has established some processes to monitor and improve safety programs and performance. The BPA Safety Office personnel conduct several types of formal inspection and work observation activities to identify safety and health deficiencies in workplace conditions and work performance. However, BPA has not established an assurance system that provides for effective and proactive assessment and inspections of safety and health programs and performance and resolution of identified problems, as evidenced by the deficiencies in safety and health programs and implementation for work performed by BPA and contracted work. As a result, program, process and performance issues are not properly identified, safety issues are not effectively managed to closure and to prevent recurrence, and responsible personnel are not held accountable for deficient performance. Improving performance assurance processes and implementation will be essential in identifying and correcting vulnerabilities to prevent recurrence.

BPA Initiatives. BPA management recognizes that recent safety performance, including four fatal accidents in the past four years, has been unacceptable. BPA management also recognizes that improvements in safety management are needed to reduce the likelihood of additional fatalities or serious accidents and has taken some promising actions (e.g., working to strengthen contracts, improving fall protection, increasing inspection capabilities through supplemental labor, and undertaking human performance improvement initiatives and benchmarking efforts). While BPA's recent and planned improvement efforts are promising, they are not sufficiently comprehensive to address the systemic deficiencies in, and the missing elements of, its current safety and health processes and practices and the need for additional safety and health staff expertise.

As another initiative, BPA plans to have an outside firm conduct a safety culture assessment of BPA operations. While this Independent Oversight assessment was not designed to evaluate BPA's safety culture and the team did not solicit information about safety culture from individuals, several important insights were gained. First, some individuals indicated that their willingness to stop work for safety concerns would depend on which supervisor was in charge; these individuals indicated that they would be reluctant to raise concerns to some supervisors. Second, a number of individuals sought out members of the Independent Oversight team and expressed concern about raising safety issues. These insights indicate that further evaluation of the BPA's safety culture is warranted and that management should ensure that the planned safety culture assessment uses validated methods and achieves high participation by workers so that it provides BPA management with valid information that can be used to support improvements.

The Independent Oversight team concluded that BPA management needs to apply significant additional attention to improving the safety and health management program in order to ensure the safety and health of BPA and contractor workers. To support this effort, the Independent Oversight team provided a detailed set of recommendations for the improvement of the BPA safety and health management program; these can be found in Section 7 of this report.

1.0 Purpose

The Office of Enforcement and Oversight (Independent Oversight), within the Office of Health, Safety and Security (HSS), conducted an independent review of the U.S. Department of Energy (DOE) Bonneville Power Administration (BPA) safety¹ management program. The review, conducted in November-December 2013, focused on BPA safety policies, procedures, and practices (performance) as applied to BPA and contracted work, as well as BPA governance and performance assurance processes and practices.

The review was conducted to provide information to BPA management that will assist BPA's efforts to improve its safety management program. In October 2013, the BPA Deputy Administrator (Acting) notified the DOE Deputy Secretary of a number of proposed actions to improve safety management, one of which was having HSS conduct an independent comprehensive safety management evaluation of BPA. BPA is making improvements in response to several recent fatalities that occurred during BPA work activities. BPA teams evaluated the causal factors for each fatality and recommended corrective actions based on each event. The Independent Oversight review complements those investigations by taking a broader look at BPA's approach to safety management.

¹ As used in this report, the terms "safety management" and "safety management program" should be interpreted to include occupational health and occupational medical aspects of a safety and health program, as well as all aspects of industrial and construction safety.

2.0 Background

BPA is one of four power marketing administrations, which are semiautonomous organizational elements within DOE that market and transmit electricity from hydroelectric plants and other sources. BPA is based in the Pacific Northwest, with its headquarters in Portland, Oregon and a support facility – the Ross Complex – in Vancouver, Washington. To facilitate remote field operations, BPA also operates district offices in 13 locations within its service territory.

The BPA Administrator reports to the Office of the Secretary of Energy. Although BPA is part of DOE, it is self-funding and covers its costs by marketing wholesale electrical power, much of which is generated by Federal hydro projects in the Columbia River Basin operated by the U.S. Army Corps of Engineers and the Bureau of Reclamation. About one-third of the electric power used in the U.S. Northwest is distributed by BPA. BPA also operates and maintains about three-fourths of the high-voltage transmission infrastructure in its service territory, which includes Idaho, Oregon, Washington, and parts of Montana, California, Nevada, Utah, and Wyoming.

The BPA workforce consists of approximately 3,100 Federal workers. Due to limitations on the number of full-time equivalent Federal employees, BPA also has over 1,250 contracted augmented staff; these individuals are employed by contractors, but typically are co-located with, and under the direction and supervision of, BPA Federal workers. Most of the potentially hazardous work performed by BPA is related to power transmission and distribution and associated support activities. As part of its transmission service activities, BPA operates and maintains about 15,000 miles of transmission lines, 43,200 transmission towers, 285 substations, and 73,000 wood poles.

BPA also contracts with companies to perform various projects, such as construction and vegetation control. BPA uses master contracts to award work tasks to contractors that are considered qualified to complete the BPA work and meet expectations; currently seven such contractors have master contracts in place for construction services. The amount of capital project work has significantly increased over the past few years (from \$20M to \$500M annually), primarily to sustain and expand the transmission system, and is expected to continue at the high levels through 2023.

Potential hazards are varied and widespread across BPA and include physical, electrical, chemical, ergonomic, and some biological hazards. Operation and maintenance of high-voltage transmission lines and substations involves exposure to such hazards as high voltage, falls, confined spaces, radio frequency radiation, and machinery and tools (e.g., chainsaws), as well as hazards associated with transportation, aerial observation (helicopters and airplanes), heavy lifting, and material placement. Construction work involves various hazards, such as those associated with high voltages, heavy equipment, trenching, scaffolding, elevated work, rotating machinery, and other typical construction hazards. Other work activities involve industrial hazards, including activities in shops (e.g., sheet metal shop, machine shop, carpenter shop, paint shop, plumbing shop, small equipment shops), several heavy equipment shops (e.g., vehicle maintenance), and laboratories (chemistry and high voltage laboratories). Typical hazards found in these areas include exposure to chemicals and fumes, rotating equipment, lead, noise, and sharps. Much of the shop work occurs at the BPA Ross Complex, although some is performed at various district support facilities.

In accordance with a memorandum of understanding between DOE and the Department of Labor, BPA is subject to Occupational Safety and Health Administration (OSHA) regulations and OSHA inspections. Federal workers are covered by the Federal OSHA regulations, and contractors may be covered by the Federal or state OSHA programs. BPA contractors are not subject to the DOE worker safety and health

(S&H) regulation (10 CFR 851) because they are under OSHA regulatory jurisdiction.

The BPA Administrator also has the authority to require that BPA officers, employees, contractors, and subcontractors comply with requirements contained in BPA policies and procedures. In accordance with DOE Delegation Order #00-033.00B, BPA is required to follow a few DOE directives but the BPA Administrator is authorized to determine whether other DOE directives, or parts of those directives, are applicable to BPA.

BPA has experienced a number of accidents and safety-related events in recent years. There have been four fatal accidents since 2010: an equipment accident in October 2013, a high voltage event in July 2013, a fall event in September 2012, and a construction site backhoe event in March 2010. In addition, BPA occupational injury rates are about twice the DOE averages.

As a result, BPA management recognizes a need to improve BPA's safety record and culture. In an October 2013 message to the DOE Deputy Secretary, the BPA Deputy Administrator outlined a number of planned and ongoing actions to improve BPA's safety programs and performance. One of these actions was a request that HSS conduct this independent comprehensive safety management evaluation of BPA. Other actions that BPA has initiated or planned include integrating BPA into several of DOE's ongoing safety programs and collaborations (e.g., DOE's operating experience and electrical safety resources), seeking HSS assistance in identifying potential enhancements in BPA safety programs, seeking HSS assistance in conducting an effectiveness review of lessons learned and corrective actions from prior accidents, incorporating lessons learned from the recent fatality into BPA's construction and inspection activities, and accelerating a comprehensive review of the S&H requirements clause in BPA's prime and subcontractor contracts.

3.0 Scope and Methodology

The Independent Oversight review of BPA's safety management program focused on BPA's safety management policies, processes, and performance. Safety management policies and processes that were reviewed included work planning and control processes, S&H programs and procedures, roles and responsibilities, contract management (as it relates to S&H, including evaluation of contractors, flowdown of requirements, and oversight), governance (i.e., requirements and document management, internal oversight, and issues management), lessons learned/operating experience, training, and stop work policies and practices.

The Independent Oversight team also evaluated safety performance at substations, transmission line and construction sites, Ross Complex facilities, and shops at district offices by observing selected work discussing work plans and performance with workers and supervisors, and inspecting safety related equipment used at various locations during the onsite portion of the review.

The scope of the Independent Oversight review includes three major areas, which are discussed in the following three sections of the report:

- Section 4 addresses BPA worker S&H programs and implementation, and associated BPA management systems such as work control practices, requirements management and document hierarchy systems, and S&H training. This section focuses on work performed by BPA Federal employees and contracted augmented staff (i.e. supplemental labor), which is common throughout the BPA system, and examined such work activities as substation operations and maintenance, transmission line maintenance, and work in various facilities and shops.
- Section 5 addresses contracted work S&H programs and implementation. This section focuses on work that is contracted out to prime contractors and their subcontractors, such as construction of new facilities (typically related to office space, maintenance, storage, and electrical transmission), civil engineering (e.g., trenching, concrete work, steel tower assembly), and vegetation control.
- Section 6 addresses BPA performance assurance systems as applied to S&H programs and management systems that affect S&H. This section focuses on BPA "corporate" feedback and improvement processes for safety management, including processes for evaluating the adequacy of processes and performance, investigating events, managing identified problems, and identifying and applying lessons learned for work performed by BPA and its contractors

Additional information about the scope of the review and the specific Independent Oversight team activities in each area is provided in the above sections.

Section 7 provides Independent Oversight's conclusions and a set of recommendation that is intended to help BPA management in identifying options and potential solutions for various issues identified during the review. Supplemental information about the Independent Oversight review is provided in Appendix A. Additional Independent Oversight team observations and analysis of BPA safety management systems and work planning and control are summarized in Appendices B and C, respectively. Additional information related to S&H performance for contracted work is provided in Appendix D.

4.0 BPA Worker Safety and Health Programs and Implementation

This section focuses on worker S&H programs that apply to BPA workers, including BPA Federal employees and contracted augmented staff (also called supplemental workers).

The Independent Oversight team observed work performed by BPA workers in the Ross Complex, district shop facilities, laboratories, and substations and field transmission line locations throughout four BPA Districts (i.e., Longview, Olympia, Salem, and Covington). The Independent Oversight team observed many types of work activities included high voltage equipment testing, preventive and corrective maintenance, modification, construction, and material handling activities. Examples of specific tasks that were observed included establishment of electrical clearances, testing and preventive and corrective maintenance within substations and on transmission line towers, inspection of safety-related equipment, fabrication of metal components, assembly, component cleaning, electronic assembly, laboratory testing, materials movement, transmission system repair, metal working (machining, assembly, cutting, grinding, welding, and surface etching), electronics assembly, cable repair testing, heavy equipment maintenance, painting, and carpentry.

In addition to observing work, the Independent Oversight team reviewed various management systems that are intended to ensure that requirements are established, communicated, and understood by BPA workers, including: requirements management, document hierarchy and management, work instructions (e.g., procedures), and Safety & Health (S&H) training. The Independent Oversight team reviewed various BPA documents that establish or communicate requirements including the following:

- The BPA Manual, which includes chapters that when combined with laws and regulations are intended to govern management of various programs. Chapter 180 of the BPA Manual, “Safety and Health Program,” requires that BPA be responsive to the laws and rules in the field of occupational S&H contained in OSHA Part 1960, the “Federal Employees Occupational Safety and Health Program,” OSHA Parts 1910 and 1926, American National Standards Institute (ANSI) Z88.2-1980, and the American Conference of Governmental Industrial Hygienists (ACGIH).
- BPA S&H documents, which are referenced in Chapter 180 of the BPA Manual. These included primarily the BPA Accident Prevention Manual (APM) (which provides rules), the BPA S&H Handbook (which provides guidance), and the BPA Work Standards Manual (which provides additional information for work on transmission systems).
- Work standards and guides developed by BPA or various BPA work groups (e.g., Substation Maintenance and Transmission Line Maintenance) that apply to specific activities.

Overall Assessment

The Independent Oversight team observed many work activities carried out safely by skilled individuals. For example, the Independent Oversight team observed that BPA Substation Operations, Substation Maintenance, and Transmission Line Maintenance workers skillfully and safely performed routine work activities within switchyards, substations, and transmission line right of ways, and took effective measures to de-energize high-voltage equipment and address the electrical hazards. BPA’s recent efforts to improve fall protection measures were also evident during Independent Oversight observations of work.

However, the Independent Oversight team observed or identified numerous examples and indications of unsafe or less-than-adequate conditions and practices at work sites (i.e., OSHA violations). In many cases, the various BPA S&H documents did not adequately establish and communicate applicable requirements. In other cases, requirements had been established but not adequately communicated to the

workers, or the requirements were not understood and followed by the workers at job sites. For example:

- Workers were observed in high noise areas without hearing protection and use of hearing protection was not always implemented in accordance with applicable requirements.
- At several Ross facilities and District shops (noted in Appendix C) machine tools (e.g., saws) were observed that were available for use that did not have proper machine guards to protect machinists and nearby workers. Requirements for machinery operation/guarding including operator certification, training, use instructions, etc. are not formally or adequately defined.
- Workers performing welding, cutting, or brazing are not adequately monitored to ensure that they are protected from fumes, and the applied controls are not sufficient to protect them against potential respiratory hazards. In addition, welding operations do not have sufficient controls such as effective provisions for hot work permits, fire watches, designated hot work zones, combustible loading, and local exhaust.
- The respiratory protection program does not meet several aspects of OSHA requirements, including the fundamental requirement to select respiratory equipment based on an evaluation of the hazards.
- BPA has not collected sufficient exposure data for some hazards (e.g., noise levels, air monitoring, and lead) and thus does not have the information needed to determine the appropriate controls.
- Some eye wash stations were not properly maintained and tested, and some may not be functional.
- Laboratory ventilation systems were in use for which testing and certification had lapsed. Neither local ventilation systems nor laboratory ventilation systems are sufficiently maintained and tested to verify their effectiveness.
- Personnel performing electrical work in proximity of high voltage equipment did not follow grounding requirements and some grounding conductors were not within their required inspection dates.
- A number of gas cylinders were not properly secured, creating an increased risk of damage, leaks, and explosions.
- Some workers were provided with respirators without being medically qualified or fit tested, or were provided with a respirator with the inappropriate cartridge for the type of exposure hazard (e.g. using an organic respirator cartridge when working with acid gases).
- Slings and wire ropes were available for use without status identification or a formal process to ensure sling or wire rope inspections were conducted as required. Methods to implement requirements for materials handling equipment are not adequately defined, including programs and/or responsibilities for conducting daily, pre-use, or annual equipment inspections of equipment (e.g., slings and wire harnesses) required by OSHA.
- Adequate lead monitoring and controls are not in place, although work with lead is common at BPA facilities. Cadmium awareness and lead worker training are not always provided for workers who may be exposed to cadmium at any level and to lead above the action level. BPA does provide lead awareness training or instructions about personal protective equipment (PPE) for these hazards.
- Postings for hazards (e.g., noise, asbestos, and lead) are not compliant with requirements and are not effective in providing information to workers.
- Required equipment inspections and training for fork lift operators are not consistently performed.
- OSHA required annual audits of specific safety programs were not performed (e.g., for lockout/tagout).
- BPA does not have the systems in place to manage and operate an effective medical surveillance program (e.g., little exposure monitoring is performed, so it is not feasible to identify a need for increased medical monitoring).

In some cases, BPA has appropriate policies and processes in place to communicate safety and health requirements to BPA workers. For example, BPA has safety controls that appropriately address hazards associated with many work activities involving high voltage equipment. In addition, BPA recently focused on enhancing its safety controls for elevated work to reduce the risks of falls. However, the

deficiencies noted above result from weaknesses in the safety and health management program and work planning and control processes. Many aspects of these BPA systems are not sufficiently developed or effective in establishing and communicating requirements and ensuring that workers understand the requirements and have required training. In addition, although BPA has established a set of manuals and handbooks that describe requirements, functions, responsibilities, and guidance for many S&H program elements and processes, they do not constitute a comprehensive or effective set of systems to manage worker S&H. The Independent Oversight team also identified several important deficiencies in management systems for establishing and communicating S&H requirements to the workers including:

- Many of the existing documents are outdated and poorly written with insufficiently defined roles, responsibilities, authorities and accountabilities.
- There are no corporate level program documents essential for managing compliance with rules and regulations and the BPA documents intended to ensure protection of worker S&H are not comprehensive and have numerous deficiencies, such as unclear and conflicting provisions.
- BPA has no requirements management program that identifies all externally-mandated S&H rules and regulations that apply to BPA activities and no system to ensure that applicable rules and regulations are translated through policies, program descriptions, and implementing procedures and guidance down to the working level.
- Some safety programs (e.g., hearing protection, lead controls, air monitoring, respirator, ventilation) are not adequately defined, contain conflicting requirements, are not communicated to workers, and are not effectively implemented at the work site.
- BPA has not established an effective corporate work planning and control management system to ensure work scopes are clearly defined and that activity specific hazards and associated controls are identified and implemented prior to performing work. The informal work planning and control processes used by BPA rely too much on the expertise of individual workers to identify the risks and determine appropriate controls for a wide range of potential hazards.
- BPA mechanisms (e.g., procedures, training, supervisor instruction) for informing workers about hazards and controls are not consistently effective; in several observed cases, supervisors and workers were not aware of hazards and the associated requirements, or the applied controls were inappropriate for the hazard (e.g., respiratory protection, grounding, step and touch, etc.).
- Site-level training programs are not sufficiently effective to ensure that workers understand the specific hazards in the workplace and the controls that must be implemented to mitigate those hazards. BPA has no formal training program that ensures that required technical training for all categories of workers is properly identified and scheduled, and that these workers receive required initial and refresher training from qualified instructors with defined lesson plans before they are allowed to perform or continue to perform work.

Overall, BPA S&H processes, as currently implemented, rely too heavily on the individual workers' knowledge and experience at the time of work, rather than on a structured work planning mechanism with written instructions that supplement individual knowledge and skills. Overreliance on the worker creates a risk that necessary controls may not be identified, adequately implemented or followed in the course of work. When controls were clearly established and communicated (e.g., high voltage work), workers usually followed these controls. However, in many other cases, workers were either unaware of hazard controls or did not have an accurate understanding of the hazards or controls, in part because the requirements were not well documented or communicated to the workers. These conditions represent vulnerability to BPA and potential S&H risks to BPA Federal employees and supplemental workers.

The remainder of this section provides additional information about the following important BPA S&H management systems and processes that are intended to support and ensure safety of BPA workers:

- Requirements Management
- S&H Document Hierarchy and Management

- S&H Programs and their Implementation for BPA Work Activities
- BPA S&H Training.

For each of the above areas, the Independent Oversight team identified the management system weaknesses and deficiencies that are contributing causes for the S&H functional area process and performance deficiencies described above. In addition, Section 6 provides information on BPA assurance processes that were not sufficiently effective in identifying and correcting deficiencies in BPA worker safety programs and practices.

Requirements Management

A comprehensive requirements management system is a key element in ensuring identification and compliance with applicable regulations and proper assignment of roles and responsibilities to organizational elements responsible for implementation.

While BPA has many documents and programs that cite requirements, and is aware of the need to comply with applicable regulations such as OSHA, BPA does not have an effective requirement management system. As a result, institutional methods for implementing some requirements are not established and requirements are not always clearly communicated, resulting in over-reliance on informal mechanisms and insufficient knowledge and understanding of requirements.

Numerous examples of requirements management weaknesses were identified during this review. In several cases, applicable OSHA requirements were not effectively incorporated into BPA S&H program documents (see subsection on safety programs later in this section). In addition to the above requirements that are not formally addressed by the BPA S&H program documents, there are also many examples of existing S&H requirements specified in the BPA Manual that are not being properly flowed down and implemented. The following are examples where there was insufficient evidence available that institutional requirements were being implemented or performed:

- BPA Manual Chapter 180, *Safety and Health Program*, specifies that the Safety Manager and staff provide the lead or oversight role for “internal safety and health program evaluations.” The BPA S&H Handbook, Section A, Chapter 1, *Safety and Health Program*, repeats this responsibility and specifies one of the program elements is that “inspections and program evaluations are performed by line managers, supervisors, employees and Safety staff for program management and oversight purposes and for meeting DOE and OSHA requirements.” This Handbook chapter also describes “periodic audits and evaluation studies by BPA personnel.” However with the exception of OSHA-required annual workplace inspections performed by BPA safety managers, the Independent Oversight team could not identify evidence of any planned or documented S&H assessments by BPA.
- Section 188.6.B of Chapter 188, *Fire Protection Program*, requires the BPA fire protection program to be documented, but no evidence of a documented BPA fire protection program could be found.
- Section 188.7 of Chapter 188 states that a fire protection system impairment program shall be provided, facilities shall have procedures governing the use and storage of combustible, flammable and hazardous materials, and there shall be a program to identify, prioritize and monitor the status of fire protection related assessment findings/recommendations. However no such programs or procedures could be located. In addition, section 188.7 requires training for individuals within the fire protection organization and the fire department. BPA has no fire protection organization or fire department.
- Section 4.E, of Chapter 100, *BPA Manual Policy*, states that BPA Manual chapters must be kept current, reviewed and updated every five years. However, Chapter 188 was last updated in January 2001 and assigns responsibilities to organizations such as the transmission business line that no

longer exist. A number of other BPA Manual chapters are similarly outdated, such as Chapter 180, *Safety and Health* (2001) and Chapter 189, *Explosive Program* (2002).

- Section 180.6G of Chapter 180 states that the ACGIH standards are applicable to BPA operations; however, these standards have not been captured in BPA programs and processes.
- Section 180.6.A, states that the Central S&H Committee (CSHC) is appointed by the Senior Vice President for Employee and Business Resources, in collaboration with the Chief Operating Officer. However the current Chair of this committee, whose title is Vice President, Transmission Field Services, was not appointed as indicated, but inherited the committee chair position when taking the Vice President position.

S&H Document Hierarchy and Management

To effectively flow down requirements to the working level, appropriate implementation vehicles need to be identified. These governance document types need to be arranged in a defined hierarchy from top level corporate policies to individual organizational implementing instructions and guidance (e.g., policies, plans, programs, standards, procedures/instructions, guidance). The purpose, format, and management elements and the associated roles, responsibilities, authorities and accountabilities (R2A2s) need to be defined for each of these documents at the corporate level. The R2A2s for document management need to address aspects such as document preparation, concurrence, approval, issuance/distribution, associated training or communication needs, revision, periodic review, and controlled use (e.g., reference, in-hand, and verification of latest revision before use). Such a management system provides the tools to ensure that safety requirements and management expectations are flowed down into the workplace and into work execution, and provides the basis for assurance systems to evaluate program and performance adequacy and compliance.

However, as noted above, the Independent Oversight team determined that BPA has not established effective mechanisms for identifying all safety requirements and assigning responsibilities for their implementation. Further, BPA does not have a clearly defined and reliable hierarchy of documents (e.g., policies, programs, procedures, training plans, guidance, etc) and structured document control system (i.e., review, approval, and change control) to establish implementing processes and clearly and consistently communicate these to personnel. The lack of structured systems for managing requirements is a systemic weakness and contributes to deficiencies in implementation of S&H requirements.

BPA's collection of S&H management documents does not adequately and clearly assign roles and responsibilities associated with worker S&H. In many cases, assignments of responsibility are incomplete, outdated, or are in conflict with or inconsistent with regulatory requirements. For example BPA Manual Chapter 188, *Fire Protection Program*, is out-of-date and unclear on responsibilities for implementation of several program elements called for in the "procedures" section of the manual. BPA management could not provide evidence of an impairment program, facility fire prevention procedures, or the assessment results tracking system. BPA conducts fire extinguisher inspections and criteria for periodic inspections, maintenance and testing are contained in the Safety and Health Program Handbook. However, there is no formal, specific assignment of responsibility for conducting fire extinguisher inspections, maintenance, and testing, or ensuring these activities are performed and documented. In addition, while an APM "rule" requires annual inspections of slings used for hoisting and rigging, there is no associated assignment of responsibility and there was no evidence these inspections were being performed.

BPA has many documents that contain S&H-related information, requirements, and expectations. These include the upper level BPA Manual, which has several chapters dedicated to establishment of corporate safety expectations. Subordinate to the BPA Manual are documents such as the APM, the S&H Handbook, and numerous BPA organizational and craft work standards and guides. However, the Safety

Office is not required to formally review and approve the APM and BPA organizational and craft work standards, which are owned by the CSHC and line organizations respectively. As a non-voting member of the CSHC, safety has no authority for the content of these documents, although many of these documents contain S&H guidance and/or requirements for which the Safety Office is responsible. In addition, the content and interrelationship between the BPA Manual, S&H Handbook, APM, and work standards is unclear, inconsistent, or conflicting; leading to the potential for significant confusion on the part of employees as to actual expectations for implementation. For example, key terms important to safety management and compliance are not consistently defined and used within and across the S&H documents, and there is a general lack of clarity in S&H statements in the areas of duties and responsibilities, requirements, guidance, and related areas. Some examples of these inconsistencies and ambiguities included the following:

- The terms policy, procedure, practice, process, rule, guide, standard, are used extensively and sometimes interchangeably, but only policy and procedure have been formally defined in BPA documents. “Policy” and “Procedure” are defined in BPA Manual Chapter 100. As stated in Chapter 100, “Policy” is “BPAs official position; providing the course of action prescribed by BPA for the workforce to carry out the BPA mission effectively and efficiently.” “Procedures” are “the way in which work is accomplished” and are “developed by organizations responsible for carrying out tasks in a manner that is consistent with BPA policy and applicable Federal regulations.” The remaining terms are not defined in the BPA Manual, but in some cases have been defined in subordinate documents, which may or may not be consistent with overarching corporate expectations, since they are not defined by upper level policy.
- The terms “Policy” and “Procedure,” although defined in the BPA Manual have not been flowed down consistently to subordinate documents, some of which use other terms to convey expectations or requirements. BPA Work Standard WS-1-1 and SM-STD-0-1 define the term “Standard” as “language describing an activity or procedure that must be strictly adhered to...” and “Guide” as “Language providing information that will improve the user’s knowledge, understanding, and efficiency of Work Practices and Equipment procedures.” These terms are not defined in the BPA manual. The use of vague and undefined/poorly defined terms leads to potential confusion on the part of the workforce. For example, just below the title of the S&H Program Handbook are the words, “A Guide to BPAs safety programs for employees, supervisors and managers.” The BPA Manual Chapter 180.7 also refers to the Handbook as “guidance.” However, the Handbook also contains sections called “standards and requirements,” implying this information is not guidance. The term “Rule,” used extensively in the APM, is not defined in either the BPA Manual or APM itself.
- Expectations for preparation, approval, periodic review, revision, and controlled use of most S&H documents are not consistently defined and implemented. The BPA Manual Chapter 100 includes a process for management of the BPA Manual Chapters. However, expectations for applying these or similar processes to lower tier documents such as the APM and S&H Handbook are nonexistent. With respect to work standards, there are some expectations for preparation, review and approval of BPA Work standards and Substation Maintenance Standards; however, Transmission Line Maintenance and System Protection and Control standards do not have similarly defined requirements. Craft work Standards also vary widely in format and content. Controlled use expectations and ensuring that documents are the current version are not formally defined, and hardcopies of the BPA Work Standards, APM, and S&H Handbook do not contain any marking indicating version or controlled use copy.
- Many weaknesses were noted in the clarity of S&H information contained in the various documents including duties and responsibilities, requirements, guidance, and related topics. The following statements, taken directly from the BPA Manual chapters are examples where upper tier policy statements lack sufficient clarity to determine meaning and intent, and ensure proper flowdown to subordinate implementing mechanisms:

- Section 2 of Chapter 12, *Functional Statement for Internal Business Services*, states that “Safety administers BPA's safety program, provides advice, counsel, direction, and support to all BPA federal employees to provide a safe workplace.” Safety does not appear to have direction authority as stated (non-voting member of CSHC; only has control over the S&H Handbook; and cannot change APM Rules or work standards, etc.).
- Section 4.D of Chapter 180, *Safety and Health Program*, “Organizational Managers with line responsibility for field activities are responsible for administering S&H programs commensurate with the mission, size, and structure of their respective organizations. This provision provides inadequate direction and allows for subjective determinations as to level of S&H program implementation.
- Chapter 180.4.G.3, states that the “Safety Manager and Staff are responsible for recommending, obtaining, or on occasion developing suitable (general purpose) safety and occupational health training programs.” This statement is vague with no interface to organizations that conduct BPA training such as Transmission Field Services and Human Capital Management.
- Chapter 180.6. I, states that “Safety and health training is provided through Safety and health committee functions, program elements described in this chapter, and technical and special purpose training activities.” However, no details are provided about the scope or specific organizational responsibilities for these elements in providing S&H training.
- Chapter 180.7, states that “The Safety and Health Program Handbook, provides detailed guidance for administering BPA's Safety and Health Program.” This provision implies the handbook content is guidance, rather than requirements, which conflicts with some of the handbook content.
- Section 1 of Chapter 188, *BPA Fire Protection Program*, states that its “PURPOSE” is “To establish comprehensive engineering and design standards for BPA’s Fire Protection Program.” A “program” for fire protection requires many more elements than just engineering and design standards. In addition, the Chapter identifies five high level requirements in a section titled “Procedures,” not the comprehensive engineering and design requirements as stated in the purpose.
- Section 188.6B , states that “The Safety office will establish and maintain a system to assure that the BPA Fire Protection Program is documented.” It is not clear what is meant by establish and maintain a system to assure the program is documented. In addition, Section G of Chapter 180 states that the Safety Manager and staff are responsible for administering the BPA fire protection program in BPA-owned and operated facilities, while section 188.6 states that the Safety Office will have oversight of fire protection policies and practices.

S&H Programs and their Implementation for BPA Work Activities

The Independent Oversight team evaluated current BPA written safety programs² as documented in the APM, S&H Handbook, and work standards. Some aspects of these programs adequately reflect the appropriate requirements and standards and, if communicated to and used by the workers, would contribute to safe work performance.

² Consistent with OSHA terminology, BPA uses the terms “program” and “safety program” to refer to any written document that describes a safety control. In DOE, these terms are used to describe a systemic and comprehensive system for controlling a hazard or set of hazards, such as a hearing protection program; a DOE program typically includes a set of formal subordinate processes and/or procedures and a description of the implementation mechanisms, roles and responsibilities, authorities, and revision/change control requirements. For the most part, the BPA “programs” do not reflect the comprehensiveness, detail, and specificity that is expected in a formal DOE program under the integrated safety management policy and requirements.

However, Independent Oversight identified shortcomings and deficiencies in all of the written safety programs that were reviewed. As noted previously in this section, various programs and requirements were not included or were insufficiently defined in site documents in such areas as materials handling equipment, hot work (e.g., welding, cutting, and brazing) operations, machinery operation/guarding, hazard analysis and control processes (including methods to ensure documented hazard analysis in support of PPE use), and OSHA required performance based annual audits. Additional information about deficiencies in safety programs is presented in Appendix B, which discusses strengths and weaknesses in the BPA safety programs that Independent Oversight evaluated. Appendix B includes specific examples and observations of program and implementation deficiencies, as well as a review of cable splicing because the applicable cable splicing requirements are a subject of recent worker concerns. The deficiencies in safety programs contribute to the numerous deficiencies in implementation of requirements at shops and job sites, as discussed previously in this section.

One of the most important factors contributing to S&H process and implementation deficiencies is the lack of an industrial hygiene program that ensures systematic identification, evaluation, and control of occupational health hazards and that provides an effective interface with the BPA medical provider. BPA workers could be exposed to a wide variety of occupational health hazards (e.g., lead, asbestos, mercury, noise, exposure to radio frequencies, hazardous chemicals, ergonomic stressors, welding fumes, etc.). At DOE sites, industrial hygienists would typically provide the technical knowledge and guidance for the identification, monitoring, and control of these hazards and would contribute to the development, management, and implementation of the associated safety programs. The BPA Safety Office recently added a contractor to provide certified industrial hygienist support to augment its staff. Another contributor was electrical-safety-centric expertise of the safety office; while safety managers had some formal training on other aspects of safety, the limited expertise in non electrical safety areas contributed to blind spots in S&H programs and assurance.

Many of the deficiencies in S&H practices and working conditions observed by Independent Oversight occurred because BPA does not have a systematic work planning and control process. For most industrial hazards, BPA relies primarily on “skill-of-the-worker” for hazard recognition, analysis, and control. Specific aspects of a work planning and control system that are not in place at BPA include:

- BPA has not established a process or procedure for determining when it is appropriate to involve subject matter expertise (i.e., industrial hygiene, electrical grounding, fire protection, grounding, etc.) to assist in hazard identification and development of controls for planned work.
- BPA has not implemented a job hazard analysis program to adequately determine all hazards associated with planned work, integrate the appropriate expertise (subject matter experts) into the planning process, identify the training required by the craft to safely accomplish assigned work, determine appropriate PPE requirements, and determine the scope of work that can be completed by individual craft skill categories considered “skill-of-the-worker.”
- BPA does not have processes that ensure BPA district line crews, Substation Maintenance groups, and shops understand when safety subject matter expertise is needed to assist in hazard identification and control.
- BPA has not established a process or procedure for independent review and approval of proposed preventive and corrective maintenance and modification work plans to ensure that they adequately identify and control specific hazards that may be encountered at BPA facilities or work sites.

In the absence of an adequate work planning and control process, workers were subject to increased risks because of inadequate hazard identification and training and, in some cases, inadequate PPE. Such conditions could result in accidents or injuries to workers. Additional information about deficiencies in BPA work control processes are presented in Appendix C, which also provides additional details about Independent Oversight’s observations of work conditions that are not conducive to safety.

Although lacking a comprehensive work control process, BPA has some documents (e.g., procedures, work instructions) to communicate S&H requirements to workers. However, several factors hinder their effectiveness in communicating requirements to workers. As discussed previously, there is no clear hierarchy among these S&H program documents, there is no clear mechanism for workers and supervisors to determine which documents and S&H requirements apply to their work activities, and management has not clearly communicated which BPA documents (programs, procedures and standards) are mandatory and which are provided as guidance. The lack of clear expectations for compliance contributes to workers and their supervisors not being sure if the standards and procedures in the BPA S&H Handbook are mandatory requirements or optional guidance.

Independent Oversight's observations in the field confirmed the lack of clarity in the structure and communication of expectations for using BPA processes and standards. For example, the supervisor of one of the BPA shops at the Ross Complex indicated that the BPA S&H Handbook is guidance but that workers must follow direction in work standards and the APM, even though all three of these documents may address the same hazard (e.g., confined spaces). This supervisor also indicated that clarification from management on this was warranted because, based on his line management perspective, only a violation of the APM could result in disciplinary action. Independent Oversight's observations of work activities confirmed that in many instances, BPA workers and their supervisors were not aware of or did not follow the requirements/ guidance in the BPA S&H Handbook.

As noted previously, BPA uses written safety programs to communicate requirements to workers on hazards for which OSHA requires written programs (e.g., lockout/tagout; hazard communications, or HazCom; respiratory protection; and confined spaces) and some other hazards (e.g., lead exposure, ergonomics, and hot work). However, BPA has not developed institutional, written programs for other significant workplace hazards in BPA facilities and work activities, such as welding, powered industrial truck operation, operation of cranes and derricks, and use of rigging equipment (e.g., slings, hoists, and wire ropes). As a result, there are a number of hazards for which BPA has not communicated the applicable requirements to workers through a written program.

Some BPA organizations have prepared their own safety documents to address a few of these workplace hazards, but these documents are not centrally controlled, owned, or formally reviewed and approved by the BPA Safety Office and are not used by all organizations that encounter the applicable hazards. For example, the BPA Substation Maintenance organization has developed its own safety standard for fork lift operators in that organization, but other BPA organizations that use forklifts have no written safety program or procedure for fork lift operators. Similarly, the Substation Maintenance organization is the only group that has developed a craft standard for managing potential cadmium exposures during welding, but cadmium requirements are not contained in any other BPA institutional or organizational safety documents or training. The development of safety procedures and work standards by some BPA organizations (but not others that encounter the same hazards) can result in inconsistent worker protection and work practices. Further, decisions about the use of work, safety or operator standards developed by individual organizations are driven by the individual's initiative and perspective on their value, rather than institutional processes. For example, one fork lift training provider took the initiative to incorporate the Substation Maintenance fork lift operator standards/guides into his fork lift training program, which is provided to various BPA groups, but there are no institutional processes for evaluating the standards to systematically determine whether they should be applied to other organizations.

Even when written programs or procedures exist, the Independent Oversight team observed that workers and their supervision were not always aware of the associated requirements. In addition, different documents sometimes give workers conflicting requirements. For example, BPA has issued conflicting requirements in the area of hearing protection; the APM requires hearing protection to be worn when

workplace sound levels exceed 85 dBA for an 8-hour period, whereas the BPA S&H Handbook requires hearing protection when 85 dBA is exceeded at any point in time.

Overall, BPA S&H program requirements are not well structured or always effectively communicated to workers. Some of the provisions in S&H documents are unclear or contradict provisions in other documents, and there are no effective mechanisms for readily resolving conflicts. As a result, workers and supervisors may not be aware of some requirements or must make judgments regarding whether statements are requirements or guidance and consequently many of the documented requirements and procedures (particularly in the S&H Handbook) are not followed consistently at the working level.

BPA S&H Training

Worker S&H-related training is mandated by OSHA for a number of hazards to which BPA employees and contractors working at BPA can be exposed. BPA refers to this type of training as “technical training,” which is coordinated and administered by the technical training group which is part of Transmission Field Services (TF). Section 4.A.1 of BPA Manual Chapter 8, *Functional Statement for Transmission Services*, states that the TF training group coordinates training needs for TF crafts, but does not elaborate on roles and responsibilities or implementation. As currently structured, management of and responsibility for meeting the training needs for workers outside the TF organization (BPA craft in other organizations, staff and contractors) are not addressed by this or other Chapters of the BPA Manual. As such, there is no delineation of roles and responsibilities for implementation of a comprehensive occupational S&H training program for all workers.

Based on interviews with BPA staff, there is also confusion over BPA’s responsibilities for training contractor personnel, particularly supplemental labor contractors who may be exposed to BPA hazards while working alongside BPA employees or by themselves. Some managers, supervisors and safety staff believe they have been directed not to allow contract personnel to attend any BPA safety training because they are supposed to have all required training included as part of the contracting process and such training would be the responsibility of the contracting company. However, because some aspects of hazard analysis and controls are site specific (i.e., lockout/tagout, HazCom, confined space, etc.), this approach appears flawed because contractors would be unable to provide adequate BPA-specific training on these and similar topics. Other supervisors have successfully enrolled contract personnel in BPA safety training. BPA supplied the Independent Oversight team with a document entitled “*Interim Guidance: Supplemental Labor FY 2012, Topic: Training.*” However, this document does not clarify the above concern as this guidance relates principally to BPAs funding of on the job training and non-technical training such as cyber security and use of BPA-specific systems (for example, GovTrip or Asset Suite). HSS could not locate any other official documented BPA policy or position allowing or denying BPA sponsored training for contract personnel.

The following specific weaknesses identified in programmatic S&H training at BPA jeopardize the ability of BPA to demonstrate compliance with various OSHA training regulations and ensure workers have the information needed to ensure their health and safety. For example:

- BPA lacks a centralized training department capable of administering required training for all workers exposed to BPA hazards. Technical training conducted by the TF line organization, including most of the OSHA required training, is only conducted annually during the TF scheduled district training weeks. However, TF training weeks are designed to accommodate TF employees; there is no formal mechanism to ensure non-TF employees and contractors receive required OSHA training for hazards such as asbestos awareness and lead awareness.
- BPA has no formal mechanism to ensure that workers receive the training delineated in the S&H Handbook and Technical Training Course catalog for their particular craft. Training assignment and assuring that employees have received required training is currently a supervisory responsibility and a

sampling of training records indicated that not all workers have received required initial or refresher training. While the Human Resources Management Information System (HRMIS) is used to document the completion of employee training, it does not track due dates for future training or flag overdue training to workers and/or their supervisors.

- There is no BPA prohibition against untrained workers being allowed to perform work. According to the S&H Handbook, supervisors are given 90 days to ensure new employees complete required safety training and some courses are only offered annually. Some OSHA required training is required to be given before initial work assignments.
- Most safety training is being administered and delivered by BPA safety managers, who are not professional trainers. BPA has not established qualification or certification requirements for all trainers, such as “Train the Trainer” courses or equivalent. BPA has no requirement for course lesson plans or a syllabus to ensure consistent delivery of training and that regulatory requirements for course content have been achieved. Asbestos and lead awareness classes are currently taught by Safety Office staff without any formal lesson plan or standardized presentation content.
- Some OSHA required training does not currently exist in the BPA curriculum. For example, there is no course that goes beyond the lead awareness class that is currently taught by Safety Office personnel. Some workers have the potential for exposure to lead at or above the action level, for which OSHA requires more training about lead than the awareness level (often called a Lead Worker Course). However, while the S&H Handbook identifies this level of training, it is not currently developed at BPA. Also, according to substation maintenance work standard SM-STD-17-1-1, personnel can be exposed to cadmium during brazing and welding activities; however, BPA does not provide this OSHA-required training for these individuals, and there is no mention of cadmium hazards in the S&H Handbook.

Based on the above concerns, Independent Oversight determined that BPA currently lacks an appropriately systematic technical training program that ensures that: (1) worker training requirements are clearly defined, (2) course materials are properly developed and documented and meet regulatory requirements, (3) courses are delivered using trained and qualified instructors, and (4) workers receive all required initial and refresher training prior to being allowed to perform applicable work.

5.0 Contracted Work Safety and Health Programs and Implementation

This section focuses on worker S&H programs that apply to contracted work. Such work is performed by BPA contractors and their subcontractors.

The Independent Oversight team evaluated contract mechanisms and processes that BPA uses to provide direction to contractors and to oversee contractor S&H performance. The Independent Oversight team observed work activities that were performed by several companies contracted with the BPA and their subcontractors in three BPA Districts (i.e., Tri-Cities, Spokane, and Longview). The Independent Oversight team was also provided a tour of the Celilo Converter Substation in the Dalles District.”

The Independent Oversight team reviewed ongoing contracted work activities at several locations including the: Franklin and McNary Substations; the Munro Scheduling Center in Mead, Washington; a 210 ft steel lattice tower on a 500 kV transmission line near the Bonneville Dam; and vegetation control work in Kennewick, Washington. The Independent Oversight team observed various types of work, including civil construction (e.g., trenching/excavating, concrete work, and assembly of steel to support new substation construction) in or around electrical transmission facilities; electrical work to upgrade substation instrumentation; and construction of new administrative, maintenance, and storage facilities. The Independent Oversight team was not able to observe work by construction contractors on high voltage electrical equipment (e.g., transmission lines and related electrical equipment) because weather conditions prevented such work during the onsite portion of the review.

The Independent Oversight team reviewed available documentation for each contracted work activity observed, including contract documents, technical specifications, contractor-prepared and BPA-accepted site specific safety plans (SSSPs), contractor-completed job hazard analyses (JHAs), and contractor equivalents to BPA Daily Job Briefing (J-1) forms. The Independent Oversight team interviewed various individuals at each work site, typically including the contractor superintendent, foreman, safety representative, safety watcher, and selected workers. In addition, BPA representatives present at the time of the visit, such as quality assurance (QA) representatives and project managers, were interviewed.

The Independent Oversight team also reviewed BPA contract management processes and practices, with a focus on their effectiveness in ensuring safe performance of work at job sites. Independent Oversight focused on such processes as contractual direction and BPA oversight of contracted work.

Overall Assessment

BPA has established various processes for incorporating safety provisions in contracts, and some aspects of these processes are appropriately designed. For example, BPA uses pre-screened contractors operating under master contracts for a large portion of the contracted work; the screening process considers past safety performance. Also, BPA has processes for incorporating safety clauses into contracts. Contractors are required to develop a SSSP and/or a JHA to control work.

Recognizing the significant increase in contracted work in the past few years, BPA has taken some actions to enhance their ability to manage and oversee contractors. For example, BPA established a Transmission Contract Management Office (CMO), and the Construction Management and Inspection group expanded their inspection force through supplemental labor and additional inspection full-time equivalents (FTEs) through a contractor.

BPA had also performed a self-assessment of the safety of contracted work using the agency decision framework (ADF) model in 2012. The BPA self-assessment identified several appropriate areas for

improvement, which included consolidating contract S&H clauses; involving the Safety Office earlier in the contracting process; requiring a full-time contractor safety representative on complicated projects; pre-screening contractors for safety; testing contracted employees for safety awareness before they start work; and getting the BPA field safety managers more engaged with contract work. The BPA self-assessment also identified other opportunities for improvement such as BPA better defining the scope of work and hazards; requiring contractors to submit a SSSP; and including contract language for suspension of the contract or removal from the job for poor safety performance. The recommendations from the ADF assessment were provided to senior executives, including the Administrator and the Chief Operating Officer, but were not formally adopted, possibly because of the distractions resulting from personnel hiring issues that led to changes in BPA senior management. Even though not formally approved, some of the self-assessment recommendations are being implemented (e.g., rewrite of the S&H clauses and the adoption of ISNetwork to improved tracking of contracted work S&H performance).

The Independent Oversight team observed many work activities carried out safely by skilled individuals using appropriate PPE. In many cases, contractor supervisors appropriately perform daily walkarounds, pre-job briefings, and other onsite reviews of work activities. In many cases, SSSPs or JHAs addressed the appropriate hazards and communicated the applicable requirements. Much of the observed overhead/elevated work was performed using manlifts and scissor lifts, reducing the hazards associated with using ladders and scaffolds. Workers routinely wore standard construction-related PPE (hardhats, vests, safety glasses, hearing protection, gloves, and boots) on worksites, and this PPE was appropriate for many of the standard construction hazards. Workers performing vegetation control were observed to wear appropriate PPE and performed work with due regard for safety (e.g., safe use of chainsaws and chippers).

However, the Independent Oversight team observed or identified a few instances of unsafe conditions and practices at work sites. Examples include:

- Walkways and paths had fall and trip hazards, including a steeply sloped, narrow path with debris, such as barbed wire, on the path.
- A trench did not have ladders to provide for ready egress, and excavated spoils from the trench were too close to the trench, violating OSHA requirements.
- Cutting operations that generated sparks were performed inside a facility with no hot work permit as required by the SSSP.
- An open flame torch was used to heat a hydraulic tank without an appropriate hazards analysis or consideration of safe work and fire control practices.

In addition, the Independent Oversight team observed numerous instances of safety controls or processes that were required by the contract or applicable OSHA requirements but were not followed or were not effectively implemented:

- Hazard analyses, such as pre-task safety analysis (PTSA) checklists, are not regularly conducted at the task level, and the generic hazard analyses do not sufficiently address all task specific hazards.
- Contractor compliance with SSSP requirements is not rigorous, including observed non-compliance with:
 - Daily job briefing requirements (daily briefings were brief and only covered generic work and hazards, and documentation was minimal).
 - Completion and use of hot work permits.
 - Completion and use of new hire and subcontractor safety orientation checklists.
 - Development and use of PTSAs.
 - Conduct of safety audits by crews or management.
- Processes for identifying additional PPE needed to safely perform work (e.g., respiratory protection) are not sufficiently defined or implemented.

- Contractors did not always have a procedure to ensure that occupational exposure monitoring for potential hazards (such as silica, lead, cadmium, arsenic, mercury, noise, or exposures to hazardous materials where occupational exposure limits are established by OSHA and/or ACGIH) are conducted by a qualified industrial hygiene professional or other trained/qualified individual under the supervision of an industrial hygienist.
- Processes for permitted work (e.g., hot work, confined space) were not well defined and the need to follow a confined space permitting process may not be thoroughly understood based on interviews with contractor superintendents.
- Fall protection methods were in use but were not covered by the SSSP; these alternative methods had not been sufficiently analyzed for their effectiveness and were not well documented.
- Material Safety Data Sheets (MSDSs) were not available at the work site for some hazardous materials.

These observed deficiencies in contractor practices at the work site often result from weaknesses in the BPA contract management and oversight processes. The Independent Oversight team identified the following aspects of BPA corporate processes that are particularly significant in contributing to the safety concerns at contractor job sites:

- BPA processes do not ensure that contractors have a clear understanding of requirements that must be followed while performing work for BPA.
- BPA processes for developing and reviewing SSSPs and JHAs and associated procedures are not sufficient to ensure that hazards are sufficiently identified and analyzed and that adequate controls are established for specific tasks.
- BPA processes do not ensure that contractors communicate hazards, required controls, and lessons learned to the workers.
- BPA oversight and inspections of work sites are not sufficient to identify and correct deficiencies in safety programs and work conditions.

Overall, BPA has taken some promising actions, such as initiatives to strengthen contracts and expand its inspection force through supplemental labor, and has directed some contractors to develop and implement corrective action plans (e.g., a construction company, after its recent fatal accident). However, the benefits of these initiatives have not been realized at the job sites reviewed by the Independent Oversight team; some potential improvement have not been fully implemented (e.g., the ADF recommendations), and others have been limited to the single contractor that experienced an accident, rather than applied systematically to all contractors who perform similar work.

Additional information about the above four areas is provided in the remainder of this section. Appendix D provides additional details about the Independent Oversight team's observations and concerns related to contracted work, including observations on BPA contract mechanisms and processes and positive aspects and weaknesses identified by the Independent Oversight team during work activity observations.

BPA Processes for Establishing and Communicating Requirements that Apply to Contractors

BPA's current processes call for BPA contracting officers to select appropriate S&H clauses from a set of 10 that are commonly used in contracts, depending on the scope of the work. Independent Oversight reviewed the S&H clauses and identified several weaknesses and deficiencies including:

- In at least one instance, the wrong S&H clause was included in the contract; this error was identified by the BPA Safety Office through review of the SSSP.
- The contract clauses provide stop work authority to the contracting officer's technical representative (COTR), but no clause provides workers with stop work authority, and contracts provide no clear requirement for a contractor employee safety concerns process.

- The clauses are inconsistent with regard to the development of SSSPs and/or JHAs and do not contain clear expectations for what should be included in a contractor's SSSP submittal. This lack of clarity, in part, resulted in poorly developed contractor safety programs, such as control of hazardous energy, fire safety, fall protection, confined spaces, HazCom, hazard (by task level) analysis, and the industrial hygiene programs used to ensure that occupational exposures for hazardous chemicals and physical agents are monitored and controlled.
- Contractors are not always clear on the expectation for workers to follow the contractor's corporate-wide safety requirements document and/or BPA safety related documents. Some contractors reported that BPA had inspected their work using BPA safety requirements (e.g., the BPA APM) that were not in their contract with the BPA.
- BPA does not have a consistent approach for including BPA requirements in contracts. BPA's General Counsel indicated that BPA is hesitant to tell contractors how to do the work, and has been reluctant to insert specific safety requirements or require that BPA safety requirements be followed. However, the Independent Oversight team noted throughout the review that BPA included very specific requirements from the BPA APM and other BPA safety-related documents when they saw fit, on an ad hoc basis.
- Safety Office personnel and accident investigation reports indicated that contracts do not enable BPA to obtain medical records and training records from the contractors for accident investigations or to verify training and certification.
- The contracts do not provide a mechanism for verifying fitness for duty. New hires can show up at a contractor work site and start work immediately on work requiring a high level of skill and safety knowledge. The contractor may not evaluate the new hire's ability to work safely, understand the new hire's previous work experiences in relation to the work they will be doing, or know whether the worker is medically fit for duty.

Contributing to the above concerns, Independent Oversight determined that Safety Office staff involvement in the contracting process is limited to post-award activities, such as a review of the SSSP and attendance at the pre-construction meeting. The Safety Office typically is not involved in pre-award activities, such as developing the scope of work, establishing the safety requirements, evaluating past safety performance, or reviewing the request for offer or bids. Also, Safety Office involvement in the contracting process is informal; none of the contracting or safety procedures document the roles and responsibilities of the Safety Office with respect to the contracting process.

BPA has an appropriate initiative to consolidate the S&H clauses into one contractor S&H requirements document that will be invoked along with a general duty safety clause. This initiative is intended to simplify the current approach (which entails ensuring that the correct subset of the 10 S&H clauses is appropriately applied to each contract) and ensure that the appropriate safety requirements are invoked for all contracts. The BPA initiative to consolidate, clarify, and update the S&H clauses could help address some of the inconsistencies and gaps in safety provisions of contracts that are discussed above. At the request of BPA management, Independent Oversight provided specific comments on the BPA draft *Contractor Safety and Health Requirements for Prime and Subcontractors* document concurrent with the independent assessment. Independent Oversight's comments were provided to BPA separately and addressed such areas as lack of clarity and specificity in requirements and applicability of requirements and insufficient detail in important areas (e.g., industrial hygiene, training).

BPA Processes for Developing and Reviewing SSSPs and JHAs

An important element of work planning and control is the identification of hazards and selection of appropriate controls. For BPA contracted work, this is accomplished primarily through the development of the SSSP and/or JHA. The Independent Oversight review indicates that SSSPs and JHAs do not

always reflect and communicate S&H requirements and do not always provide sufficient information to ensure compliance with OSHA requirements and BPA safety clauses. Specific concerns include:

- SSSPs typically do not provide for a structured occupational exposure monitoring program that includes the development of exposure assessment strategies for day-to-day exposures for such hazards as welding, concrete (silica) finish work, lead, organic vapors, noise, nuisance dust, heat stressors, or lighting. Contractors rarely have industrial hygiene expertise at the job site, and corporate industrial hygiene resources are not readily available to support this important S&H function.
- While SSSPs promote the use of hardhats, gloves, boots, safety glasses, and hearing protection (mostly disposable plugs), they do not invoke hazard assessment protocols to fully and accurately identify the hazard and the specific PPE required for each work task/activity.
- The SSSP/JHA processes currently do not provide a sufficient level of safety for work activities. The informal SSSP templates provided to the contractor perpetuate the development of SSSPs with inadequate analysis and controls for daily workplace hazards. Some of the SSSPs had been “cut and pasted” from other contracts, with limited analysis of the specific hazards of the planned work.
- While the SSSPs cover some programmatic safety requirements, there are no processes, such as a task hazard analysis, to ensure that hazards associated with specific jobs and tasks are identified and effectively controlled, and that workers understand the controls needed for each activity. Also, the daily job briefings are not sufficient to fully evaluate hazards and to identify any new hazards that could arise. Further, as currently defined and implemented in the field, daily job briefings normally only identify a standard list of PPE that is worn daily for all work and are not sufficient to ensure that PPE and hazard controls are appropriate for the hazards of the specific tasks to be performed.
- SSSPs do not always sufficiently address all relevant requirements. For example, the reviewed SSSPs did not always address the duties of safety watchers, and coverage of certain topics applicable to the work (e.g., lockout/tagout, PPE, fire hazards) was superficial.

Contributing to the above concerns, the effectiveness of the BPA Safety Office SMEs is hindered by late submittals of SSSPs/JHAs from non-CMO projects, allowing insufficient time for an adequate review. The designated SMEs indicate that they sometimes receive the SSSPs on a Friday for work scheduled to begin on the following Monday, leaving them insufficient time to conduct a thorough review and resolve comments with the contractor. The CMO project contractor SSSP's are typically delivered in a timely manner and the SME is given the required 10 days to review. One Safety Office SSSP reviewer indicated that he reviewed 280 SSSP/JHAs in fiscal year (FY) 2013, and also conducted safety oversight inspections of contracted work in the field approximately 15 times.

Communication of Hazards and Controls and Lessons Learned to Workers

Contractor-generated SSSPs are not sufficiently comprehensive for workers to fully understand the hazards and hazard controls. Workers need to have additional specific information on safety requirements to protect themselves from the project hazards. Language that cryptically mandates compliance with a safety requirement (e.g., “per OSHA 1910.147” or “per BPA lockout/tagout”) is insufficient for informing the superintendent, foremen, and workers of their safety responsibilities and the procedures they need to follow. BPA contract safety clauses do not require, and contractors do not typically have, processes to ensure that workers have and use the necessary hazard and control information and direction (e.g., site specific procedures on implementation of safety requirements).

As a consequence, Independent Oversight observed instances where contractor employees did not fully understand hazard identification and control requirements. For instance, several foremen and supervisors interviewed by Independent Oversight were not aware of the specific BPA safety clauses/requirements that applied to their contract. Also, MSDSs were not readily available to workers, and there were

instances where one contractor at a multi-contractor site had a lockout/tagout process but no provisions to ensure that other workers would understand the lockout/tagout provisions of another contractor. Some contractor linemen and electricians noted that they do not receive timely feedback information from BPA accident investigation reports to improve their work practices, and they were not familiar with recent BPA fatality accident investigation results. The linemen/electricians said that they mostly hear rumors about accident causes, rather than the actual causes and corrective actions needed to prevent recurrence of the causes/accidents in the future.

In response to the July 2013 fatality and a BPA stop work order and cure notice, the construction company implemented various corrective actions. Several of the actions involve providing better information to workers. The construction company's management emphasized a stop work policy and met with all superintendents and foremen to go over the accident and discuss expectations for stopping work when workers have safety concerns. They have strengthened their training program, including hiring a director of training. All new employees, as well as employees performing a new job, receive training for the job, and are vetted by the training director.

BPA Oversight and Inspections of Contracted Work Sites and Activities

As noted, BPA safety oversight of SSSP implementation in the field has not been effective in identifying unsafe conditions and non-compliance with provisions of SSSPs as written, and contractor compliance with SSSP requirements is not always rigorous. The Independent Oversight team identified a number of specific concerns about BPA oversight processes and practices. The most significant concerns are that BPA personnel devote limited time and effort to onsite reviews of the safety of contracted work, and the qualification requirements for personnel performing oversight are not well defined. The Safety Office has two experienced SMEs who support onsite safety oversight of contracted work, but these individuals devote most of their time to reviews of contracts and therefore spend limited time on job sites.

BPA COTRs provide little time in field inspection activities or observation of contractor work performance. The Construction Management and Inspection group uses BPA and contracted QA representatives and field inspectors to selectively review construction work. BPA Construction and Maintenance Services Group personnel also have a role in overseeing work, with a focus on electrical work; however, this group has not established qualification requirements for individuals who oversee contracted work, and most of their expertise is in work with high voltage equipment. Expectations for BPA inspectors to evaluate safety are described in the Transmission Line and Substation Construction Inspection Manual, which states that inspectors are to be familiar with state and Federal OSHA regulations, the APM, and BPA Work Standards. This manual identifies specific topical areas to inspect related to electrical safety and gives a minimal, general discussion of safety elements of clothing (e.g., footwear and gloves), climbing, driving, and excavations. The statement of work in the master contract for contracted QA inspectors states that they are to "verify safety requirements are in place as shown in the SSSP," verify that hold orders have been put in place, and verify traffic control. The training and qualification requirements in the master contract for inspectors is limited to holding a current CPR/First Aid card, completing a minimum of 10 hours of OSHA training, and being "able to interpret safety rules and regulations for states." These training and qualification requirements are insufficient to ensure that inspectors are capable of effective safety oversight at a job site. Other concerns about BPA oversight programs are discussed in Section 6.

6. Assurance Systems

This section focuses on BPA performance and QA processes (hereafter referred to as assurance systems) that are intended to provide assurance that activities are performed safely and in compliance with established S&H requirements. Assurance systems are corporate level governance mechanisms used by organizations in government and industry to ensure that requirements and goals for a product, service, or activity will be fulfilled. Assurance systems are used by high performing organizations to systematically measure and monitor processes and performance against defined standards, correct problems, and prevent recurrence. The purpose of assurance system elements, with regard to worker S&H, is to ensure that facility and equipment design, construction, and maintenance and BPA programs, processes and work performance all effectively contribute to and ensure the health and safety of employees.

The scope of the Independent Oversight review included BPA performance assurance processes that are applied to work performed by BPA (including BPA employees and supplemental labor) and to contracted work. Independent Oversight interviewed responsible BPA personnel, reviewed documents and performance records, and observed safety meetings to evaluate BPA assurance processes, procedures, and mechanisms.

Overall Assessment

BPA has various elements of an assurance system in place, some of which are relatively mature and are used to monitor and improve S&H programs and performance. BPA conducts generally robust formal investigations of serious injury accidents and operational events with safety implications, including recommendations for preventing recurrence. BPA has also established several formal mechanisms for reporting of safety concerns and near miss incidents. The BPA Safety Office also conducts several types of formal inspection and work observation activities to identify S&H deficiencies in workplace conditions and work performance. In addition, BPA has arranged for contracted inspection oversight for large construction projects and frequent job observations by field Safety Managers. The resolution of some safety issues, such as for Accident Investigation recommendations and the Near Hit and Safety Issues reported to the Safety Office are tracked in separate spreadsheets.

However, BPA has not established a comprehensive assurance system that provides for effective and proactive assessment and inspections of S&H programs and performance. S&H programs and performance are not being routinely evaluated or subjected to effective oversight by Safety or line management, as evidenced by the numerous deficiencies in safety programs and performance identified in Sections 4 and 5. While significant accidents and events are formally investigated and some onsite assessments and observation are performed, the requirements and process steps for these limited inspection practices have not been formally detailed in procedures and have not been effectively implemented. Many of the weaknesses and deficiencies in S&H programs, processes, and performance that Independent Oversight identified during this review could have been self-identified and corrected by BPA if BPA had effective routine assessment processes.

In addition, BPA assurance systems are not sufficiently defined and implemented to ensure that identified problems are fully evaluated and corrective and preventive actions are effectively tracked to completion. While BPA uses a number of processes for reporting safety issues, injury and operational incidents, events and near misses, the administration and application of these processes are not defined in written procedures and implementation is often problematic. Identified S&H problems are not effectively evaluated, appropriate corrective and preventive actions are often not developed or implemented, and disposition actions are not performed in a timely, well documented manner or effectively tracked to

closure. As a result, program, process, and performance issues are not properly identified, safety issues are not effectively managed to closure and to prevent recurrence, and responsible personnel are not held accountable for deficient performance.

One of the factors contributing to deficient performance is that BPA has not applied proven standards for designing, establishing, and implementing its assurance system elements. The Secretary of Energy has granted the Administrator and Chief Executive Officer of the BPA the authority to determine, with certain exceptions, which directive or parts of directives are applicable to the BPA. DOE Order 226, *Implementation of Department of Energy Oversight Policy*; DOE Order 414, *Quality Assurance*; and the associated guidance documents define assurance system elements applicable to safety programs, but BPA has determined that these directives will not be applied to BPA. BPA has also not committed to industry standards that address assurance systems, such as the International Organization for Standardization's ISO 9001, *International Standard Model for Quality Assurance in Design/Development, Production, Installation, and Servicing*.

BPA management recognizes that improvements are needed in some aspects of safety management. Prompted by recent fatal accidents, BPA senior management requested this Independent Oversight review and informed the DOE Deputy Secretary (via email) of its plans for other improvements, such as participating in the DOE operating experience and lessons learned programs, performing an effectiveness review of past accident lessons learned and corrective actions, accelerating the review of safety clauses in contracts, and implementing corrective actions for the recent fatal accident involving a construction company. In addition, BPA is benchmarking industry and utility programs to identify S&H best practices. The BPA Safety Office participated in the FY 2012 Edison Electric Institute Utility Safety Benchmarking study and is conducting its own benchmarking effort, facilitated by an outside contractor. The initial phase of benchmarking was a survey questionnaire sent to 10 electric utilities and four non-utility companies with reputations for safety excellence and best practices. BPA then visited six utilities and three non-utility companies for face-to-face interviews. An interim report has been issued summarizing 7 broad conclusions and 23 specific findings based on the feedback from the industry questionnaire. BPA is evaluating the gaps between these identified industry best practices and BPA policies, and is assessing the benefit of aligning BPA policies with DOE directives. Several presentations have been made to senior management summarizing the current status of BPA policies and practices versus industry best practices and the status of the benchmarking efforts. This Independent Oversight review is intended to help BPA clarify the current status of its safety programs and performance.

BPA is also planning to have an outside contractor conduct a safety culture survey in calendar year (CY) 2014. While this Independent Oversight review was not designed to characterize BPA's safety culture, some important and concerning insights were gained through interviews and discussions with personnel. When questioned about willingness to stop work for safety concerns, some individuals indicated that their willingness to express concerns depended on the supervisor. While the team did not solicit safety concerns during interviews with personnel, a number of individuals approached the team and expressed concern about raising safety issues. In addition, representatives of some current contractors have indicated that they have not incorporated the full range of their corporate safety processes into their proposals for BPA work so that they remain competitive (but still meet BPA expectations). While anecdotal, the comments from contractors indicate that BPA safety programs are not currently consistent with DOE and industry best practices. These insights may be useful as BPA designs its safety culture assessment. If effectively performed in accordance with systematic and proven methods and measures and a high level of participation, the planned safety culture assessment could provide essential information about the organizational culture and could support other S&H program improvement efforts.

While BPA's recent and planned improvement initiative are promising, they are not sufficiently comprehensive to address the systemic deficiencies in and missing elements of key S&H-related

management systems. As noted above and described in more detail below, important elements of an effective performance assurance system, are not effectively designed and implemented to support and ensure the safety and health of BPA and contractor workers by providing assurance that deficient S&H practices and conditions are identified and corrected in a timely manner.

The remainder of this section provides additional information about key elements of BPA assurance systems including: assessment-like activities, accident investigation and reporting, employee concern reporting and resolution, S&H issues management, injury and illness reporting, and lessons learned/operating experience. For these areas, the Independent Oversight team focused on identifying weaknesses and deficiencies that contribute to the S&H functional area process and performance weaknesses and deficiencies detailed in Sections 4 and 5 of this report.

Assessment-Like Activities

Periodic reviews of programs, processes, and performance are necessary to provide assurance that S&H requirements (e.g., OSHA requirements) are being effectively implemented to protect workers and comply with rules and regulations. BPA internal documents or OSHA specifically requires a number of S&H programs to be periodically evaluated. As noted earlier in the requirements management section, portions of the BPA Manual and BPA S&H Handbook identify specific requirements for performing assessments but documented S&H program or performance assessments were not being performed. Examples of OSHA mandated periodic inspections (requiring onsite records) that are not being performed and/or not adequately documented include the following:

- Annual review of confined space entry permits
- Annual review of lockout/tagout energy control procedures
- Annual review of the BPA Chemical Hygiene Plan.
- Triennial review of powered industrial truck operator performance.

A limited amount of inspection activity is being performed and documented by BPA and its contractors. For example, Safety Managers conduct annual OSHA workplace inspections, monthly job observations, and review contractor Site Specific Safety Plans for construction projects. Field inspections on some construction projects, including contract safety requirement compliance, is performed by a BPA subcontractor and the Safety Office compiles and performs OSHA required analysis of injury and illness statistics. However, the expectations and requirements for the scope, methodology, and documentation of these limited inspection/work observation activities being performed are not formally defined. Further, inspection personnel are not provided with assessment training, standardized checklists, guidance, or other tools. Consequently, reporting of inspection and observation activities is often poorly and inconsistently documented, typically through electronic mail, and there is insufficient management administration or oversight to ensure that the expected frequency or quality of the activities are being met or that records are properly maintained. Safety Office job observation reports in some cases did not identify the date of the observation or the observer.

Independent Oversight reviewed approximately 25 Safety Manager Job Observation reports documented in the past year. In addition to the above described process problems, many of these reports reflected insufficient rigor in the inspection, analysis, and documentation of the observation activities. For example, key elements such as the conduct and content of pre-job briefings, proper hazard identification and control, or lockout/tagout performance are not addressed or are cryptically described, such as “thorough pre-job brief conducted.” The use of PPE was the one element consistently described.

Independent Oversight also reviewed approximately 10 sub-contractor construction field engineer and QA inspector reports in the Contractor Administration Information System. These reports rarely

identified any safety related observations and then only very minor issues, results that do not align with the observations of procedure and performance weaknesses identified by the Independent Oversight team. Further, in several of these reports there were violations of safety requirements documented in photographs or text that were not identified by the safety observers as violations:

- In one case, a Safety Manager job observation report described that, during electrical work, an electrician heard an “arcing sound” coming from within a panel and the electrician determined it was a loose wire coming out of a ferrule on the terminal block. The electrician then “pushed the wire back into the ferrule, held it there with one hand while he used his other hand to call for assistance on his cell phone.” However, there was no discussion in the report about whether the electrician had adequately assessed the hazards of the situation and responded in a proper and safe manner by intentionally contacting an energized and loose conductor and at the same time using a cell phone.
- In another report, the observer discussed watching BPA and contractor electricians troubleshooting a small fire that had occurred in a relay panel during opening of a switch disconnect, but did not note whether the incident had been properly reported or investigated or any discussion of lockout/tagout.
- Another report stated that fire extinguishers in work trucks had not been inspected “recently” (no details on how out of date they were from required monthly inspections). After a discussion with workers indicated that this was a Ross Complex responsibility, the observer suggested that they do their own inspections. The question of who is responsible and authorized and accountable was not addressed.

The Independent Oversight team reviewed the results of several recent annual OSHA required workplace inspections, as performed and documented by BPA Safety Managers. Although deficiencies were identified and reported to facility management for resolution, there again was no defined process for the planning (to ensure all areas are inspected), conduct, or reporting of the inspections. In addition, BPA is regularly inspected by OSHA inspectors and have been cited numerous times for various violations of OSHA safety requirements. While the deficiencies cited by the OSHA inspectors have typically been resolved within the authorized abatement period, extent of condition reviews have rarely been performed to identify other similar deficiencies or to identify the root cause of the deficiency. For example, a laboratory fume hood in one of the Ross chemistry labs that was cited by OSHA in 2007 for a lack of ventilation testing. Although ventilation testing for this hood was performed within 90 days of the OSHA citation, the hood has not been tested since (contrary to the requirements of the ANSI standard, which requires an annual face velocity flow measurement). In addition, the Independent Oversight team observed that none of the other laboratory hoods have been tested as required.

BPA safety oversight of contracted work and SSSP implementation in the field has not been effective in identifying noncompliance with provisions of SSSPs as written and contractor compliance with SSSP requirements is not always rigorous. The Independent Oversight team identified a number of specific concerns about the BPA oversight processes and practices. The most significant concerns are that BPA personnel devote limited time and effort to onsite reviews of safety of contracted work, and the qualification requirements for personnel performing oversight are not well defined. The Safety Office has two SMEs who support contracted work, but these individuals devote most of their time to reviews of contracts and therefore spend limited time on job sites. The Construction Management and Inspection group uses QA representatives and field inspectors to review construction work. While there is an informal expectation for these individuals to oversee the safety of the contractor work activities, this expectation is not well defined or communicated and the individuals have limited training on industrial S&H requirements and issues. BPA Construction and Maintenance Services Group personnel also have a role in overseeing work, with a focus on electrical work. However, BPA’s Construction and Maintenance Services Group has not established training or qualification requirements for individuals who oversee safety of contracted work to ensure that they are capable of performing their assigned responsibilities. The individuals currently performing the oversight have expertise in working with high voltage equipment but do not necessarily have training or experience in the broad range of industrial S&H

practices and requirements that are relevant to the work sites.

Accident Investigation and Reporting

As requested by BPA, the Independent Oversight team reviewed the BPA policies and processes for reporting, investigating and addressing issues from serious injury and operational accidents/incidents. BPA has established a defined process requiring the conduct of accident investigations and BPA is conducting formal team investigations, documented in accident reports, for serious injury accidents and for operational events with significant safety implications. BPA Manual Chapter 181, *Accident Investigation and Reporting*, describes the responsibilities of employees, supervisors, the Safety Office, the S&H Manager, and the Accident Investigation Board (AIB), and the “Management Accident Investigation Team” regarding the reporting and investigations of accidents and the implementation and tracking of corrective action plans. Three levels of accident (designated as Level I, II and III) are defined in this manual chapter and an AIB is to be appointed to address Level I and II accidents.

While this manual chapter provides general definition of the accident investigation process, it is not a procedure or detailed process description. Consequently, it lacks sufficient detail on roles and responsibilities in several areas. For example, the responsibility and expectations for investigation of Level III accidents are not described, although a number of Level III accident investigations have been conducted and reported (at least nine in the past two years). The manual chapter also does not adequately describe the makeup or administration of the management accident investigation team, which is collectively responsible for reviewing AIB recommendations, implementing corrective action plans, and assigning organizations to address the AIB recommendations. The Safety Office is designated as responsible for tracking all recommendations “adopted by the Team” and report on their status. However, the methods for establishing the composition of the management accident investigation team or how it “adopts” or rejects recommendations or who develops corrective actions plans is not described. S&H Handbook, Section C, Chapter 1, *Accident Reporting and Investigation Process*, also describes elements of the investigation process, but does not further describe the functioning of the management accident investigation team, nor does it describes the member’s collective responsibility to approve “corrective actions” for Level I and II accidents/report recommendations.

Although BPA Manual Chapter 181 and the S&H Handbook both state that it is BPA policy to thoroughly investigate “all serious accidents and near misses” and that the purpose of the process is to “establish the requirements and procedures for investigating accidents/incidents within the BPA system,” there was some level of management misperception or misinterpretation of these requirements regarding the July 2013 construction contractor fatality. As noted in the report, there was an eight day delay in appointment of an AIB while BPA management and general counsel made a determination if the accident investigation process applied to contractor accidents. The AIB report stated that the delay resulted in difficulties with collecting evidence, conducting interviews, and securing and preserving the accident scene.

Independent Oversight reviewed and evaluated eight recent (CY 2011-CY 2013) formal AIB reports of serious injury accidents and operational events. The review focused on the quality and completeness of the documentation, the approach and thoroughness of the analysis of causes and the appropriateness of recommendations for action. With the exception of serious injury accidents involving construction and vegetation management contractors (as opposed to supplemental labor contractors), it appears that BPA has a reasonably low threshold for conducting formal investigations of precursor or lesser significance events as indicated by the nine Level III investigations conducted in the past two years. Each of the AIB investigation reports reviewed by Independent Oversight describe the event in a generally detailed manner (including photos and drawings), identify causes (direct, contributing and root), and identify conclusions (designated as “findings”) and recommendations to address each of the findings. Finished reports are signed and dated by the AIB members.

Although the reviewed reports contain much pertinent information, credible analysis, and generally appropriate findings and recommendations, there are a number of weaknesses in these investigations and reports. Most of the reports do not provide sufficient details on important safety elements (e.g., whether the job briefing was performed, adequate and documented; whether there was a BPA requirement or procedure to perform some activity related to the event; what kind of oversight was provided by supervisors, foremen, safety managers; other work planning or control aspects of the event). The reports do not have attached copies of completed pre-job/JHA forms or participant/witness statements, or other pertinent supporting information. Although the causal analyses generally appropriately identified various causes, the identified “root” cause analysis typically did not perform a sufficient analysis to answer the “why” question set or adequately address latent organizational and management deficiencies. None of the reports identify the various weaknesses in S&H programs and associated management systems identified in this Independent Oversight report. Lastly, there is no specific evaluation done to link recommendations and or subsequent specific corrective actions to addressing the identified causes, especially contributing causes.

As an example, the AIB report for the July 2013 construction company fatality cited the failure of the work crew to establish an equipotential zone as the root cause of the accident. However, there were 11 contributing causes cited reflecting 6 instances of failure to follow procedures, and several of unclear roles and responsibilities in BPA and contractor documentation. Although there were many appropriate individual recommendations addressing failures to follow procedures, the broader, collective issue of procedure non-adherence was not addressed in the analysis or the recommendations. This report reflected many examples of recommendations focused on the one contractor and one crew without considering the possibility that the same issues could exist in other contractors or elsewhere within the BPA workforce, processes and activities.

AIB reports and recommendations also do not address the need for implementing or considering compensatory measures pending development and implementation of corrective and preventive actions to address the recommendations. AIB analyses typically do not address the potential extent of the conditions contributing to the event and most recommendations are directed at only the crew or group involved in the incident without analysis of applicability to other crews, other contractors, other districts, or other BPA organizations. Many AIB recommendations are appropriately phrased as defined, broad judgments of need and use terms such as “ensure,” “monitor,” or “enforce.” Further, effectively addressing an AIB recommendation may well entail multiple discrete actions. However, BPA Manual Chapter 181, BPA S&H Handbook Section C Chapter 1, and the AIB related action tracking system (discussed in the Safety and Health Issues Management section below) focus on tracking the closure of recommendations, not discrete actions, which are not input to the tracking system or required to be documented in a formal corrective action plan. Lastly, recommendations and the associated actions taken tend to be focused on one-time events such as “training” in the form of discussions with involved employees and briefings at safety meetings or at annual group “training” sessions, rather than incorporating them into formal documentation or training to ensure embedding the resolution for the benefit of employees in other organizations, future employees, and new work activities.

These weaknesses in accident investigation and reporting, when combined with the problems discussed below in monitoring and managing the implementation of corrective and preventive actions, including lack of verification, validation and effectiveness reviews for these actions, reflect the need for management attention to a program that addresses the most significant safety matters at BPA.

Employee Concern Reporting and Resolution

Various means are available for employees to report safety concerns at BPA including safety committees,

a Safety Office homepage hotlinks, and direct reporting to supervision or to the Safety Office staff. The BPA Safety Office maintains tracking mechanisms for AIB recommendations and safety issues and near hit reports, and the CMO administers contractor near miss reports on the Contractor Accident and Incident System. The safety issues reporting mechanism has been in place since June 2009 and the near hit report mechanism was established in May 2013. However, these tracking tools have no associated procedures describing the requirements and processes for managing the tracking and resolution of recommendations and reported concerns and, as discussed below, there are deficiencies in the management of these reporting systems. There are no requirements for conducting independent verification of completion of corrective actions, validating that completed actions addressed the problem/recommendation, or for performing follow-up effectiveness reviews to ensure that the issues were effectively resolved. In addition, there is no formal employee concerns program that would provide a vehicle for independent, confidential safety concern reporting and resolution, a function that serves to enhance worker trust in management's concern with their safety and health.

S&H Issues Management

Independent Oversight reviewed the content of various spreadsheets or databases that BPA uses to track S&H-related issues/problems including Accident Investigation Board recommendations, construction contractor near miss reports, and safety issues and "near hits" reported by BPA employees to the database hot links on the Safety Office homepage. No management system provides policies, procedures (requirements, process steps, R2A2s), and guidance for overall issue identification, risk ranking, evaluation (e.g., cause and extent), and resolution (i.e., corrective and preventive actions), or action tracking (including verification and effectiveness reviews on a graded basis). The existence of multiple, fragmented tracking mechanisms for problems/resolutions without formal processes precludes/hampers any effective trend analysis.

There are many deficiencies in the tracking documentation for the resolution of AIB recommendations. The information in the AIB Recommendation Tracking Report (spreadsheet) reflects untimely and inadequate tracking of recommendation actions. The tracking report lists the recommendations, the management owner, the date of assignment, a task owner, the estimated completion date, a completion/closure date, and a field for notes. However, the specific actions to be taken are not identified.

The review team selected a sample of ten consecutive AIB report/recommendation entries for events occurring between December 2011 and September 2012 to evaluate recommendation action status, assuming that these were relatively recent events, with actions that should have been completed by December 2013. Of the ten reports, nine had recommendations that were identified as open and overdue and/or had not had the status updated since entry in the spreadsheet or in CY 2013. Of the approximately 90 recommendations listed, 45 were open and overdue, and the status had not been updated; 10 were overdue; and 34 were listed as closed. Many recommendations were closed with somewhat cryptic notations referencing e-mails (i.e., "completed per TES e-mail" or "complete as of 4/23/12"). In a number of cases the recommendations were closed with notations that indicated the actions were not yet completed (i.e., "training is begun and is ongoing," "studies are ongoing," and "TFVI will ensure that"). In at least three cases, recommendations were closed with notations indicating no action would be taken, without indicating the "TEAM" approval of this disposition of an "approved" recommendation. In addition to the above issues, there appears to be a lack of ownership of the AIB issues/needed actions for recommended actions as there was no indication of additional actions identified beyond the recommendations in the AIB report. Although it is possible that other actions were taken, nothing is documented in the tracking report.

Contractors reported 79 injuries or near miss incidents in CY 2011 and 92 in CY 2012. Many of these

involved inadequate work planning and control including failure to identify or mitigate hazards, lack of planning/procedures, or failure to follow established requirements. Although the most significant reported events likely have BPA contracting officer/COTR reviews and possibly sanctions, there is no formally defined procedure for required BPA safety oversight of these reports to assess proper significance determination, sufficient investigation, the adequacy of specified actions planned or taken, or assurance that actions were taken. The contractor incident/near miss report, required to be submitted to the contracting officer and the Safety Office within five working days of the occurrence, has a field for review by “BPA Designated Employee” (undefined). The review team examined a sampling of 21 contractor incident/near miss reports generated in the previous 12 months and only three had a signature in the BPA Designated Employee block. The statements by the contractor supervisor in the completed action taken block typically were general in nature and focused on telling the worker what to do or not do (e.g., “use a spotter,” “communicate better,” and “pothole before digging”) without identifying or addressing any organizational weaknesses in work planning and control processes, procedures, training, or oversight. The actions block did not indicate who was to take actions or a date when those actions would be completed.

The safety report is one of the primary methods promoted by BPA management for employees to report and get resolution of safety concerns. The Independent Oversight team evaluated the information in the safety report tracking database maintained by the Safety Office. The location and access to this database is not communicated on the Safety homepage, as would be appropriate for ready access to interested employees, but it is located on the Safety Sharepoint site. The location of information on the resolution of safety concerns reported by employees should be prominently advertised and visible. Of the 99 concerns logged in the database since the program inception, only 21 were designated as having been resolved. This incomplete data or unacceptable completion rate for safety issue resolution (if accurate), do not demonstrate BPA management’s policies and commitment to maintaining a safe and healthy work environment to BPA employees.

The Independent Oversight team examined the 15 BPA “near hit” reports reported to this recently created reporting tool. The report form, and the Safety Office database, contain the information provided by the reporting individual, including general fields and statements about how and why the incident happened and what should be done to prevent the incident, but contains no fields indicating any review by Safety or management, for assigning management ownership of the issue(s) involved, documenting any formal evaluation of the event or any actions taken or to be taken, action due dates, or closure/completion information. Soliciting the reporting of, and tabulating details about, close encounters involving S&H hazards, without addressing formal analysis of the incident and identification of any needed actions provides little value to improving safety or demonstrating to employees management’s intent to prevent subsequent accidents.

Independent Oversight also evaluated how the deficiencies identified during the annual OSHA workplace inspections were being managed. There are no defined procedures or expectations for the management of the resolution of annual OSHA inspection deficiencies. There is also no tracking or verification process to ensure actions are completed or completed in a timely manner. Further, there is no collection or analysis of results performed to identify repetitive deficiencies, excessive deficiencies of certain types warranting greater management attention/action, or to evaluate relative performance of BPA Districts or corporate-wide performance trends.

Injury and Illness Reporting

Independent Oversight conducted a limited review of the oversight of recordable injury/illness cases by BPA supervision and the Safety Office. The Safety Office home page has a link to a page of instructions on how to report non-serious injury accidents or illnesses, motor vehicle accidents, and contractor near

misses, injuries, accidents or illnesses. Reporting forms for each type of incident are identified. Case management for OSHA required reporting of recordable and days away or restricted injuries and illnesses is performed by the Safety Office staff with input from the Medical Program Manager. However, there is no written procedure or instructions on case management or reporting of injuries and illnesses. Further, there is no requirement or defined management expectations for Safety Office review, involvement, or concurrence with the event evaluations and corrective/preventive actions identified by supervisors on OSHA injury reporting forms either for BPA employees or contractors. Also, there is no BPA validation or periodic assessment of contractor injury reporting processes and performance.

BPA has made some improvement in the specification of corporate safety performance targets in their current Corporate Strategic Planning publication. BPA also has established safety goals for OSHA reportable total recordable case (TRC) and days away, restricted, or transferred (DART) rates. Specific goals for 2014 include achieving a DART case rate of less than 1.5 and zero fatalities and achieving a TRC rate of less than 1.6. However, the DART goals have been static for several years and BPA has devoted limited addition to systematically using safety initiatives and associated goals to continuously improve safety and prevent accidents and injuries. Further, BPA does not have a defined set of initiatives or actions to complement their established goals, such as programs for behavior observations, provisions for management and supervisors to spend time in the field observing work and mentoring workers, and incentives for workers who identify safety concerns or improvements or who contribute to safety through participation in safety committees. In addition, the BPA Medical Program Manager indicated that he has been requesting a computerized case management and reporting system each year since 2004.

Lessons Learned/Operating Experience

The BPA Safety Office publishes lessons learned reports related to BPA activity and related events are published on the Safety Office intranet homepage. Annually, approximately six to 10 lessons learned have been posted to the website. However, as with other S&H and assurance program elements, there is no defined program or process that details the BPA policy, requirements, expectations, process steps, roles and responsibilities, etc. for identifying, communicating, and applying lessons learned/operating experience. There is no outreach initiative to make workers, work planners, and supervisors aware of the lessons learned website or other operating experience links or to communicate the importance of learning from previous incidents at BPA or in similar external work activities. Although the posted lessons learned reports describe events and provide recommendations and conclusions, there are no directed corrective actions or recurrence controls or accountability for further evaluation or taking of action. As discussed in Section 5 of this report, contractors are not routinely provided lessons learned by BPA.

7.0 Conclusions and Recommendations

BPA management recognizes that recent safety performance, including four fatal accidents in the past four years, is unacceptable. BPA management also recognizes that improvements in safety management are needed to reduce the likelihood of additional fatalities or serious accidents and has taken some promising actions (e.g., working to strengthen contracts, improvements to fall protection, increasing inspection capabilities through supplemental labor, human performance initiatives, and benchmarking efforts). However, during work observations and facility walkthroughs, the Independent Oversight team identified numerous examples where necessary controls to protect workers from hazards were not implemented. In many cases, requirements were not well defined, were not adequately communicated to workers, or were not understood by workers. In some cases, BPA does not have processes to perform necessary safety functions, such as exposure monitoring, noise monitoring, and comprehensive industrial hygiene support.

The Independent Oversight team concluded that safety relies too heavily on the individual workers' knowledge and experience at the time of work, rather than written instructions that supplement individual knowledge and skills. The Independent Oversight team also concluded that weaknesses in management systems and corporate process contribute to the observed deficiencies at facilities and job sites. Safety programs are not well defined and do not address all the hazards at work sites. Mechanisms to communicate requirements to workers (e.g., procedures, job specific JHAs, precautions, limitations and controls, and training) are not sufficiently and consistently effective. Further, BPA assurance systems are not sufficient to identify and correct deficient conditions or unsafe practices for work performed by BPA employees and supplemental workers or for contracted work. While BPA's recent and planned improvement initiative are promising, they are not sufficiently comprehensive to address the systemic deficiencies in and missing elements of the current S&H processes and practices. Increased management attention on improving the safety management program is needed to ensure the safety and health of BPA and contractor workers.

This Independent Oversight review identified the following recommendations for improving BPA S&H programs and associated management systems. These potential enhancements are not intended to be mandatory but should be evaluated by BPA as ways to address significant weaknesses in current S&H programs and to reduce the likelihood of additional accidents and injuries.

BPA Management Actions

1. Ensure that an extent of condition review is performed in the near term, addressing all BPA operations, facility conditions, contracted work, SSSPs/JHAs, S&H programs, training processes, assurance systems, requirements management, and governance processes to determine the extent to which the deficiencies identified during this Independent Oversight review (including the appendices) exist in other BPA District locations and facilities and job sites. Specific actions to consider include:
 - Apply sufficient safety and health expertise to ensure that the extent of condition review effectively identifies the deficiencies; consider using external subject matter experts to complement the expertise of BPA staff.
 - Develop and implement a plan of action with milestones to correct these specific deficiencies.
 - Identify those existing hazards that present the greatest risk to workers, and assign a priority to addressing those hazards.
 - For those hazards that may present an imminent risk or long lead times for corrective action implementation, develop compensatory measures and controls, and/or curtail these activities until adequate controls are in place and permanent process/program changes are in place.

2. Establish mechanisms to ensure that management and supervision at all levels understand, accept, communicate, and instill in subordinates the need for and expectations that BPA will become a learning organization that proactively identifies, evaluates and effectively addresses safety problems and that safety is everyone's responsibility. Consider a range of actions such as:
 - Revising various statements and documents (e.g., core value statements, mission statements, web pages) to identify worker S&H as a key element.
 - Developing and issuing communications from senior management emphasizing the importance of worker safety and health and describing actions that management will be taking to improve.
 - Evaluating the organizational structure to ensure that safety is represented at a high level of the organization (e.g., a senior manager with safety expertise serving at the vice president level with responsibilities for environment, safety, health, and quality or some similar arrangement).
 - Soliciting input from labor unions and workers on effective methods to improve safety and perceptions of the work force.

3. Provide direction and resources to and monitor the effectiveness of improvement initiatives. Specific actions to consider include:
 - Continue the use of benchmarking to identify effective management systems established by successful, learning organizations, such as for work planning and control, requirements management, document management, and assurance systems. Include a review of existing DOE directives and guidance and gather insights from successful DOE management and operations contractors or groups such as the Energy Facility Contractors Group (EFCOG).
 - Use a formal project management approach to managing the development, rollout, and implementation of new programs and processes.
 - Incorporate provisions for routine, detailed reporting of progress and any problems or resource needs to senior management as part of the improvement management plan.
 - Ensure that new and revised S&H programs and associated management systems include effective policies, procedures, tools, responsibilities, and guidance.
 - Ensure that all activities are appropriately addressed including BPA directed activities (i.e., employees and supplemental contractors/staff) and contracted work of all sizes and types.
 - Include early and periodic implementation validation reviews to ensure objectives and management expectation are being met and effectiveness/efficiency is achieved.
 - Establish S&H performance objectives/goals with supporting metrics (leading and lagging), that will serve to drive S&H performance improvement. In developing such goals, consider human factors (e.g., avoid incentives that could discourage reporting injuries or events) and insights from the DOE Voluntary Protection Program and OSHA insights on incentives that promote desired behaviors.
 - After identifying required safety functions and any needed improvements in S&H programs perform an evaluation of S&H staffing and resources needs to implement an effective safety and health program, identify any gaps in current S&H expertise and resources, and determine an optimal approach to adding S&H expertise. Various approaches to add S&H expertise should be considered including additional training and professional development of current S&H staff and addition of individuals with expertise and experience in S&H programs and associated management systems. Ensure that the BPA staff has sufficient expertise to ensure adequate protection of worker safety and health in the wide range of work activities performed by BPA (high voltage work, construction, material handling, etc.), in the various S&H disciplines (electrical safety, industrial safety and hygiene, medical surveillance, fire protection, etc.) and the associated management systems (requirements management, document systems and procedures, S&H training, performance assessments, issues management, etc.)

Work Control Processes for BPA Employees and Supplemental Labor

4. Design and implement a comprehensive and consolidated safety management system, including a work planning and control process that is to be followed by all BPA managers and workers. Regardless of the system used, such as ANSI/American Industrial Hygiene Association (AIHA) Z10 or a proven system from another utility or entity, the following are keys to success:
 - Involve line management and workers in the development and revision of BPA's S&H systems and processes, and in addressing the concerns identified in this Independent Oversight report.
 - Develop work planning processes using a graded approach for construction, maintenance and shop work to ensure that all hazards are identified and assessed, that SMEs are involved, as needed to ensure appropriate hazard controls are in place, and that individuals are appropriately trained before authorizing work.
 - Ensure that the roles and responsibilities for hazard analysis and work planning and control are well defined, understood, and effectively implemented for the responsible positions including District supervision, work crew's foremen, district safety managers, and craft personnel.
 - Ensure that the work planning processes address continual safety improvement through appropriate feedback mechanisms.
 - Ensure that BPA safety management system clearly defines roles, responsibilities, authorities, and accountabilities for S&H at all levels of the organization.

5. Establish and implement a formal requirements management system and document hierarchy that ensures all applicable S&H regulatory requirements are appropriately identified, documented, understood, and flowed down into implementing procedures. Specific actions to consider include:
 - Benchmark with other DOE sites and utility and non-utility entities to identify methods being used to identify and document applicable S&H requirements, including the mechanisms used (procedures, etc) to ensure requirements are properly understood, flowed down and implemented by responsible line organizations.
 - Conduct a gap analysis to determine those areas where OSHA requirements have not been incorporated into existing BPA S&H documents, including root cause assessment.
 - Conduct a gap analysis to determine where existing requirements contained in the BPA manual are not being implemented, including root cause assessment.
 - Conduct an extent of condition evaluation to identify other requirements management weaknesses not specifically called out in this report.
 - Use information gained by the above actions to develop implementation plans and a timeline for revamping BPAs requirements management system and document hierarchy.
 - Develop formal procedures to govern the actions of personnel within various organizations responsible for implementing BPA Manual S&H requirements.
 - Develop and employ a writer's guide to ensure consistently constructed and effectively communicated documents.

6. Establish and implement a formal centralized institutional training program, separate from the line organizations, with responsibility for identifying, developing, managing, scheduling, and implementing BPA S&H training for all BPA employees and supplemental workers/augmentees, where appropriate. Specific actions to consider include:
 - Benchmark with other DOE sites and utility and non-utility entities to identify methods used to identify training requirements, develop and document course materials, manage and schedule training, deliver training, and provide for retraining as required for all employees and contractors
 - Conduct a gap analysis of existing BPA curricula against OSHA requirements to determine additional training that is needed to meet requirements.

- Establish minimum requirements for documenting training courses (lesson plans, syllabus, etc.) to ensure compliance with regulatory requirements can be readily demonstrated.
 - Establish a General Employee Training course that is required for all workers and that provides orientation to BPA operations and facilities, hazards, controls, emergency response, and similar topics.
 - Establish minimum expectations for trainer qualifications to ensure adequacy and consistency of training.
 - Revise HRMS or establish a system to include capability for documenting each employees training requirements, including refresher training, sending reminders for upcoming and overdue training, and issuance of training reports for supervisors.
 - Establish a mechanism that allows for verification that employees have completed required training/certifications before being permitted to perform work.
 - Develop an overarching BPA Training Program Document that defines the content and implementation of the BPA training program.
 - Establish a process to ensure that BPA augmented contractors/supplemental labor have completed training comparable to that received by BPA Federal workers before performing work.
7. Develop and implement a BPA industrial hygiene program with responsibility for identifying, establishing requirements and developing procedures and programs for identifying, evaluating and controlling workplace exposures (e.g. noise, lead, respiratory protection, HazCom, etc.). Provide adequate resources (i.e., staff, industrial hygiene monitoring equipment, exposure database software) to implement the industrial hygiene program.
 8. Consolidate and strengthen the current BPA industrial safety program to ensure that applicable industrial safety requirements (material handling, fall protection, welding, etc.) are identified, translated into procedures, and communicated and implemented in the shops and in the field.
 9. Strengthen the BPA Federal Safety Office staff by adding certified safety professionals, certified industrial hygienists, and a fire protection engineer.
 10. Build on the positive Substation Operations human performance improvement (HPI) initiative/experience to establish and implement a formal institutional program for training all employees and managers in the application of HPI concepts and techniques to all work activities and safety issue evaluations.
 11. Systematically address worker concerns associated with the proposed revision of cable splicing practices:
 - Ensure the BPA engineering and testing organization solicits information from cable splice kit vendors about their designs and the availability of qualified tap splice kits for 1 kV lead and polyvinyl sheathed shielded cables, including consideration of the references provided by the Independent Oversight team.
 - Determine whether the remaining lead sheath spliced poly cable sample can pass the “Test-13-133” water submergence test.
 - Revise or delete the current Appendix O of the BPA Substation Construction Specification to reflect BPA’s decision on the best alternatives for lead and poly sheath cable splicing.
 - If it is decided to continue efforts to qualify a new cable splice technique, solicit electrical splice kit vendor recommendations on the most appropriate tapes and taping sequence and include such information in a revised Appendix O. As a minimum, consider using glass tape as the first pass over the crimped H lug to mitigate the concern that flexing the spliced cable may compromise the lug insulation.

- If spliced cables are to be subject to cable pulling stresses, perform additional tests to demonstrate that the revised Appendix O splices will remain functional.
- If it is planned to splice lead sheathed cables still found in BPA systems using the revised Appendix O splice technique, perform additional tests to demonstrate that the resulting splices are both safe and reliable.
- Consider including the revised Appendix O cable splicing guidance or its equivalent as a requirement in the technical specifications of new construction, modification, or maintenance contracts.
- Develop and implement a strategy to efficiently identify and then repair contractor and previous Appendix O cable splices that may not meet current BPA safety and environmental reliability expectations.

Work Control Processes and Contractual Safety Provisions for Contacted Work

12. Strengthen the policy and process for worker stop work authority. Consider making stop work a stand-alone section in the planned Contractor Safety and Health Requirements for Prime and Subcontractors document and address the Independent Oversight team's comments on the stop work aspects of this document which were provided separately to BPA.
13. Systematically evaluate contracts and direction to contractors with the goal of providing clarity in the safety requirements for contracted activities. Specific actions to consider include:
 - Identify BPA requirements (e.g., from the APM) that should be mandatory for contractors to ensure consistency of safety programs for BPA contracted work.
 - Benchmark the practices of other Federal agencies, such as the U.S. Army Corps of Engineers, and good practices recognized by the Edison Electric Institute, to identify effective practices for establishing consistent requirements for job sites that may involve multiple contractors.
 - Evaluate the benefits of referencing the National Electric Safety Code and the IEEE industry consensus standards, which are specifically intended for the electric utility industry and provide fundamental principles and good engineering practice for a safe working environment.
 - Include contract language that provides BPA access to sufficient safety-related training documentation to verify that training and certification requirements are met.
 - Include contract language that provides BPA access to sufficient medical summary information in case of a fatality or serious accident.
 - Evaluate the benefits of translating the safety improvements made by a construction company to address a recent fatal electrical accident causes to requirement that would be applied to all Master Contract contractors and other contracts of appropriate size and/or risk.
 - Reevaluate the recommendations contained in the ADF for the evaluation of the safety of contracted work and take documented action to adopt them into requirements as appropriate.
 - Revise the SSSP/JHA processes to ensure that they provide a sufficient level of safety for the work activities and sufficient detail and specificity to identify safety expectations, including expectations for subordinate processes and procedures for job hazards.
 - Perform periodic assessments of contract provisions and direction to ensure their effectiveness in establishing and communicating requirements to the contract workers.
14. Systematically evaluate BPA capabilities and processes for managing and overseeing contracted work with the goal of providing an appropriate level of BPA SME involvement in the contract and SSSP and sufficient qualified BPA oversight of contracted work in the field and job sites. Specific actions to consider include:
 - Establish a more structured process for involving the Safety Office throughout the contract process, including pre- and post-award contract activities. Document the roles and

responsibilities of the Safety Office in the Bonneville Purchasing Instruction (BPI) and other policies and procedures as necessary to implement these functions.

- Conduct a staffing analysis to determine the appropriate number of FTEs needed to handle the increased contract construction work, including an analysis of the knowledge, skills and abilities needed in the areas of construction and occupational safety, as well as industrial hygiene.
- Formally define occupational S&H oversight tasks for contractor oversight positions, to include frequency of onsite oversight, documentation of safety issues and corrective issues, and qualification requirements for QA representatives and field inspectors. Consider requiring the 30-hour OSHA construction safety course for workers who have some safety responsibilities where construction is the primary work activity.
- Define qualification requirements for individuals who oversee safety of contracted work activities. Consider requiring additional safety and occupational health training for oversight personnel (safety staff, COTRs, QA representatives, and field inspectors) such as the OSHA 10-hour General Industry and 30-hour Construction Safety courses for the non-safety professionals and additional non-electrical safety related training for safety staff.

Assurance Systems

15. Establish and implement a formal, corporate level, assurance management system and implementing procedures. At a minimum include provisions for the following elements:

- Routine and periodic evaluation (assessment and inspection) of S&H programs, processes, and performance.
- Comprehensive training on assessment concepts and techniques (with practical exercises or mentored assessment activities) for all Safety Office staff with oversight responsibilities, construction inspectors, COTRs, and line managers.
- Addressing (i.e., capturing, categorizing, evaluating, resolving, tracking correction and preventing recurrence, and verifying/validating resolution of) all safety related issues reported by employees, identified during assessment or inspection activities, or resulting from operational incidents/events and injuries/accidents.
- Screening, identifying, developing, disseminating, and applying lessons learned from internal BPA operating experience and from external experience that applies to BPA work activities and processes.
- Establishing a formal employee concerns program and organization that fosters free and open expression of employee S&H concerns (including provisions for employee confidentiality or anonymity), provides for independent and objective evaluations, and ensures that concerns are promptly and effectively addressed.
- Ensuring that AIB recommendations are translated into formally approved action plans and that the actions are effectively tracked to verified implementation. Incorporate effectiveness reviews into action plans to validate that actions had the desired outcome and were sufficient to prevent recurrence.

16. Strengthen BPA injury, illness, and event investigation processes and implementation to integrate established HPI concepts and techniques to focus on identifying and addressing latent BPA and contractor organizational and management weaknesses that are contributing to poor S&H performance. Specific actions to consider include:

- Train AIB members in HPI concepts and analytical techniques.
- Employ a mentor/facilitator for initial AIBs after HPI and causal analysis training.
- Incorporate formal effectiveness reviews into corrective action plans for significant (conservatively defined) operational incidents/events and injuries/accidents.

APPENDIX A

Supplemental Information

Dates of Review

Onsite Reviews: November 18-21, 2013
 December 2-12, 2013

Office of Health, Safety and Security Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer
William A. Eckroade, Principal Deputy Chief for Mission Support Operations
John S. Boulden III, Director, Office of Enforcement and Oversight
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APPENDIX B

BPA Safety Management Programs

This appendix provides the Independent Oversight team's evaluation of selected individual BPA safety management programs. For each program, applicable requirements and positive aspects are cited, as well as aspects of the program that warrant improvement, including specific implementation deficiencies. The information in this appendix is used to support the Independent Oversight evaluation of BPA safety management performance in the main report.

Hearing Conservation Program

Requirements: 29 CFR 1910.95; BPA S&H Handbook Chapter B6; APM Rule H-2; BPA Manual Chapter 180 Section G; Professional Industrial Hygiene; and ACGIH.

Most of the shops that were inspected have varying degrees of noise hazards. Hearing impairment is one of the more prevalent potential hazards at most BPA shops and among the field electricians. For example, in 2011, BPA recorded 19 hearing threshold shifts (i.e., recordable injuries).

Chapter 180 of the BPA Manual invokes the ACGIH threshold limit values (TLVs) as requirements for the BPA workforce; for noise, these are more limiting than the OSHA requirements in 29 CFR 1910.95. On the positive side, BPA has provided opportunities for workers to be fitted for molded ear plugs at BPA's expense, and many workers were observed wearing hearing protection in high noise areas.

However, BPA work areas receive insufficient noise monitoring to determine whether hearing protection is required or voluntary, and whether the hearing protectors provided or in use are adequate for the noise levels experienced at the work sites. Other concerns about the design and implementation of the hearing conservation program are:

- Interviews with supervisors indicated that most hearing protection is provided only on a voluntary basis and is not assigned by line management based on a hazard assessment, as required by OSHA. The selection and use of hearing protectors are up to the individuals, and in some cases they may not provide adequate protection against the noise to which workers are exposed (e.g., Ross Sheet Metal Shop).
- A large number (more than 700) of the BPA workers are enrolled in the BPA hearing conservation program. However, there is no noise monitoring data to support enrollment. BPA workers are enrolled into the hearing conservation program based on their assigned work group, but their enrollment is not based on their actual noise exposures. BPA provides workers enrolled in the hearing conservation program an opportunity to have their hearing tested on an annual basis; however, the program is voluntary, and workers are not required to participate. OSHA mandates hearing tests as part of the hearing conservation program.
- The Independent Oversight team interviewed contractor supplemental labor staff who worked for three of the prime supplemental contractors. None of these supplemental workers were enrolled in a hearing conservation program (no training and no annual audiograms). However, the noise exposures for supplemental workers can be the same as those experienced by BPA workers who are in the BPA hearing conservation program. For example, the Switchboard Shop has nine contractor workers from three contracting organizations and none of them are enrolled in a hearing conservation program. Conversely, all BPA workers assigned to the Switchboard Shop (who perform the same type of work as the contractors) are in the BPA hearing conservation program. Similar situations are evident for supplemental labor in the Sheet Metal, Carpentry, and Plumbing Shops.
- BPA program requirements for hearing protection are conflicting. For example, the APM specifies a threshold of 85 dBA for 8 hours, while the S&H Handbook indicates that hearing protection must be

used whenever sound levels are above 85 dB. Furthermore, the noise doses cited in the S&H Handbook and APM are based on the OSHA 5 dB doubling rate, but the BPA Manual is based on ACGIH requirements, which use the more limiting 3 dB doubling rate, so that the same sound level exposure would result in a higher noise dose using ACGIH requirements.

- There are few documented noise surveys of BPA workplaces in any of the areas that Independent Oversight reviewed. Such surveys are needed to determine when and where hearing protection is required. BPA personnel indicated that some sound level data existed but the data was more than a decade old and could not be readily found or provided to the Independent Oversight team. Similarly, BPA has no documented noise dosimetry data and thus cannot determine a worker's noise "dose" with respect to the hearing conservation requirement.
- A number of shops and field groups work ten-hour shifts or longer (e.g., Sheet Metal Shop). Work shift schedules over eight hours would reduce the daily noise dose exposure criteria that apply to these workers. The length of the shifts has not been factored into BPA's informal hearing protection practices.
- BPA facilities have few hearing protection postings, although high noise levels (sometimes very high noise levels over 100 dBA) are clearly present. In a few cases where there are hearing protection postings (e.g., hearing protection requirements painted on floors within the machine shop), workers typically view them as legacy postings and do not follow them.
- The BPA Safety Office lacks sufficient noise instrumentation to assess sound levels (sound level meters) or noise dose (noise dosimeters).
- The BPA high voltage lab has some sound level instrumentation and is performing field measurements of noise, at the request of BPA field sites. The BPA Safety Office is not involved in or aware of these measurements. In most organizations, a central safety organization would be responsible for directing noise measurement efforts and evaluating and using the results.

Lead Program

Requirements: 29 CFR 1910.1025; S&H Handbook Chapter F3.

Lead, in a variety of forms, is soldered, drilled, cut, shaped, molded, and heated in a number of BPA shops and is regularly used in the field for cable splicing. Lead appears in soldering of electrical components in the Switchboard Shop, and sheet lead is used in the General Shops for cable sheaths, lead weights for transmission lines, etc. Numerous OSHA requirements govern lead use, and lead exposure is one of the most significant potential health hazards for a number of BPA work activities.

The BPA S&H Handbook has a good description of the health effects of lead and identifies exposure limit requirements for exposure monitoring, etc. However, the workforce is often unaware of the requirements and health effects of lead, and the requirements are not consistently implemented.

Assessing worker exposures to, and controls for, lead is a priority focus for the new BPA industrial hygienist. Of the small group of 22 BPA workers in the medical surveillance program, none have exhibited elevated blood lead levels. However, the surveillance program does not include many of the workers who are routinely exposed to lead.

The following observations are of concern to the Independent Oversight team with respect to the lead program:

- BPA has no industrial hygiene monitoring data for employees who work with lead to assess their exposures to lead, including potential overexposures (e.g., machinists who drill lead weights, sheet metal workers who work with lead sheets, and electronics workers who may use solder containing

40% or more lead). Therefore, BPA does not have a mechanism to determine whether workers who work with lead are being overexposed to lead.

- OSHA standards and requirements are based, in part, on the potential for lead exposure, which is determined by air monitoring data. Since BPA has no industrial hygiene air monitoring data for lead, BPA cannot determine which elements of the OSHA lead standard should be invoked.
- There are no documented safety controls to limit or mitigate lead exposure or to minimize the spread of lead contamination. For example, some workers who routinely work with lead (cable splicers) reuse their clothing during lead activities and have their personal work clothing laundered at home, increasing the potential for transferring lead to their home environments. Further, some lead contaminated BPA work clothing is laundered through a cleaning service company, which has not been informed that the clothing may contain lead. In the past few weeks, BPA has initiated surface monitoring for lead.
- There are no defined BPA work practices for working with lead. A pallet of lead sheets, some of which were oxidized, was observed in the Sheet Metal Shop, but the shop had not defined or documented controls for handling lead work products. A machinist in the Machine Shop drills lead weights, but has no documented requirements (PPE, housekeeping, etc.) to control exposure or contamination. BPA construction and maintenance crews routinely encounter legacy lead-sheathed power and control cables in substation tunnels and trenches during substation modification and maintenance activities.
- Lead awareness training is not well documented (i.e., no training lesson plans) and varies in content based on the trainer. The lead awareness training is typically not offered to contractors who provide supplemental labor, and contractor organizations do not regularly provide lead training to their workers. For workers who are routinely exposed to lead in the workplace, OSHA requires lead worker training; this training is not available at BPA. The Independent Oversight team interviewed a cable splicer, who is routinely exposed to lead, and learned that he had not received any lead training.

Chemicals and the Hazard Communication Program

Requirements: 29 CFR 1910.1200, BPA S&H Handbook Chapter FI, and ACGIH.

Many BPA and contractor workers in the shops and the chemistry labs use hazardous chemicals and are exposed to a variety of solvents, glues, epoxies, etc. These materials have adverse health effects if not used appropriately, and some are classified as reproductive toxins and carcinogens. Violations of the OSHA HazCom standard, which is intended to protect workers from these hazards, are typically among the top three types of violations cited by OSHA in the United States. In 2011, in response to an employee complaint, OSHA cited BPA at the Ditmer Control Center Building for not providing information and training on hazardous chemicals in their work area.

On the positive side, BPA has developed web-based training to communicate the new Global Harmonization Standard (GHS) requirements. OSHA required completion of training on the new GHS pictograms and safety data sheets (SDSs) by December 1, 2013; the SDSs will replace the traditional material safety data sheets (MSDSs). Many BPA workers (and some contractors) appear to have received this training.

However, not all supplemental personnel have been provided information and training on the hazardous chemicals that are present in their work areas. BPA supplemental labor organizations do not provide this training, and BPA provides such training for contractors only at the discretion of the BPA supervisor. For example, the Switchboard Shop recently provided this training to both BPA and supplemental staff.

The Independent Oversight team identified a number of concerns with respect to the design and

implementation of the BPA HazCom program:

- The OSHA HazCom standard requires that workers be trained on the BPA HazCom program, and also be trained on the hazards of specific chemicals in their work areas. BPA offered HazCom training during the most recent week of district training; however, the training was not typically offered to BPA employees outside the Transmission Field Services organization (such as BPA employees in many of the shops) or to any supplemental labor employees. Workers in these other groups may not have received the HazCom training required by OSHA.
- The current BPA HazCom training provided by BPA safety managers does not have documented training lesson plans and is not reviewed and approved by the training department. As such, the content can vary depending on the trainer.
- The most recent GHS training supplements, but does not replace, the requirement for HazCom training. However, some individuals in the BPA Safety Office did not clearly recognize this point.
- In addition to basic HazCom training, OSHA also requires work area specific HazCom training to inform workers of the chemical hazards in their workplace. BPA has no guidance for this type of training and, based on interviews, does not conduct work area HazCom training in the shops or in some field locations; training deficiencies in this area were the subject of a 2011 OSHA citation.
- A random inspection of chemicals in the workplace shops identified chemicals for which there was no MSDS in the workplace (e.g. Plumber's Shop).
- OSHA requires a documented hazard analyses for chemicals for which PPE is in use to protect workers against the hazards of the chemical. BPA does not have such hazards analyses, even though PPE is used by workers for various tasks.
- A wide diversity of hazardous chemicals are used in the BPA shops and facilities; some of which may be time sensitive, acute toxins, skin irritants, respiratory hazards, carcinogens, reproductive hazards and/or may affect specific body organs. Although OSHA has considerable discussion and requirements for these chemicals in the mandatory appendices to 29 CFR 1910.1200, the BPA Hazard Communication program does not address these hazards or identify any specific controls.
- When using chemicals, workers and their supervisors do not always use the information in the MSDSs to decide on the appropriate PPE, relying instead on their prior experience or information from others. In a number of cases, the MSDS indicated that the protective chemical glove selection was inappropriate for the chemical hazard.
- A number of requirements/guidance in the BPA S&H Handbook regarding HazCom are not being followed (e.g., requirements for employee training).
- The HazCom chapter of the S&H Handbook has been updated to reflect the new GHS labeling requirements (which OSHA does not yet require to be implemented in the field). However, chemical containers observed in the field did not meet the GHS labeling requirements of the BPA S&H Handbook (e.g., use of signal words, pictograms).
- The Ross Complex Chemistry Labs Chemical Hygiene Plan is outdated (last issued in 1991) and does not meet some of the basic OSHA requirements for a chemical hygiene plan.
- The chemists working in the Ross Complex Chemistry Labs who were interviewed were unaware of the OSHA requirements in 29 CFR 1910.1450 for their laboratory (e.g., special precautions for carcinogens and reproductive toxins).
- The Ross Complex Chemistry Labs do not have a designated chemical hygiene officer as required by OSHA. This function is typically fulfilled by the chemistry lab supervisor, but at BPA, chemists are supervised by electrical engineers, who are typically less knowledgeable of the hazards associated with chemistry laboratory operations.
- Other chemical concerns in the Ross Chemistry Labs include chemicals in secondary containers that are not properly labeled (DTX-11), and acids improperly stored in flammable-storage cabinets, instead of in cabinets designed for acid storage.

Respiratory Protection Program

Requirements: 29 CFR 1910.134, S&H Handbook Section B8.

A number of the workers, including BPA workers and supplemental workers, in the BPA shops use respirators while performing some of their work activities. Respirators in use in the BPA district shops include filtering face-pieces (dust masks), half face and full face respirators, and supplied air systems. Respirators are typically used by painters, plumbers, machinists, and carpenters and for general shop work.

BPA provides respirators for BPA employees' use. In some cases, the supplemental labor contractors provide respirators (Switchboard Shop). In other cases, respirators are provided by the unions (Plumbing Shop). Some BPA foremen also require that linemen be qualified for respirator use in the event of an emergency, such as leakage of SF₆ from circuit breakers. The Ross Complex Paint Shop is installing a new state-of-the-art breathing air system that provides supplied air for workers during blasting and painting operations.

The Independent Oversight team observed the following deficiencies with respect to the BPA respiratory protection program and its implementation:

- The need for respiratory protection and the selection of the appropriate respirator must be based on a qualitative or quantitative evaluation (air monitoring) of the respiratory hazard(s). This requirement is established in the OSHA standard and is a fundamental industrial hygiene practice as defined by the American Industrial Hygiene Association (AIHA). However, this basic requirement is not met at the BPA shops or in the field. To date, there have been no documented qualitative evaluations, and air monitoring for potential respiratory hazards has been minimal. BPA provided no records of any air monitoring when requested by the Independent Oversight team. BPA personnel indicated that an outside industrial hygiene contractor had occasionally been used to perform exposure monitoring. However, according to the BPA Safety Office, the hardcopy records were scanned and disposed of, and the scanned electronic files could not be located.
- The BPA Safety Office does not have an electronic filing system appropriate for tracking and trending industrial hygiene exposure records, including respiratory protection records. BPA's Project Wise software is designed for facility planning, not for industrial hygiene record keeping. Currently, no one in the Safety Office has been assigned the responsibility for maintaining industrial hygiene records. The inability to retrieve worker training records was a finding during the investigation of the March 2010 equipment (Bobcat fatality at BPA).
- In some cases, the BPA respiratory protection program outlined in the BPA S&H Handbook is inconsistent with respirator use in the field (e.g., some types of respirators in the field are not addressed in the BPA program), and requirements from the handbook are not being implemented (e.g. chemical cartridge replacement schedule, respiratory care and maintenance, and respiratory inspections). A number of respirators observed by the Independent Oversight team were improperly stored, or stored in a dirty environment.
- Respirator fit testing for supplemental labor workers does not always conform to OSHA requirements, and BPA does not audit the respiratory protection programs of the supplemental labor contractors. In one case, for example, a supplemental worker assumed that a "fit test" for their half-face respirator consisted only of selecting a respirator and ensuring that the respirator "fit" their face, without completing a medical evaluation to determine whether the worker was medically qualified to wear a respirator; in this case, the worker also did not participate in a fit test with a challenge gas or Port-a-Count test as required by OSHA. Furthermore, although the use of respirators without a medical evaluation or approved fit test was documented on the employee's experience and training record, this deficiency was not reviewed or challenged by BPA.

- BPA workers are fit tested on the respirator that the employee brings to the fit test trailer, regardless of whether the respirator being fit tested is the appropriate respirator for the hazard. There is no documented hazard analysis to verify that the worker has the appropriate respirator for their workplace hazards. In some cases, workers may be tested for a half-face respirator, but the magnitude of the workplace hazard may require a full-face respirator since each type of respirator has a different protection factor.
- Both BPA and contractor workers make considerable use of filtering face pieces (dust masks) in the district shops and in the field. Workers and their supervisors who were interviewed by the Independent Oversight team did not recognize that these dust masks are respirators according to OSHA and are to be controlled through the BPA respiratory protection program. There are no hazard evaluations to support the use of dust masks.
- The S&H Handbook requires that the Local Program Coordinator (i.e., supervisor) or Program Administrator review the circumstances under which the dust masks are used to ensure that their use does not create additional hazards to the employees. There are no records that any such reviews have been conducted. For example, the carpenter in the Carpenter Shop periodically uses a dust mask during woodworking activities that could involve the use of hazardous chemicals. However, the shop personnel did not know whether respiratory protection (a dust mask) is required for his activities, whether the dust mask is the appropriate respirator for the hazards, or whether the dust mask can be used on a voluntary basis for the work being performed.
- In one case, at the equipment degreaser in the machine shop, workers used a respirator with organic vapor cartridges, instead of an acid gas cartridge, when degreasing equipment with a mixture of hydrofluoric and phosphoric acids. There is no indication that this respirator provides adequate protection from the acid vapor hazard.
- Several of the BPA supplemental worker contractors do not provide respirator fit testing services for their employees. For example, the BPA industrial hygienist is a supplemental laborer and was unable to obtain a fit test through his contracting organization.
- The BPA-designated pre-job briefing form (J-1 form) provides line management an opportunity to document potential respiratory hazards that may require a further evaluation by BPA Safety. However, such hazards are typically not documented on the J-1 forms, and the J-1 forms are not submitted to the BPA Safety Office for review.

Asbestos

Requirements: 29 CFR 1910.1001, 29 CFR 1926.1101, BPA S&H Handbook Section F Chapter2.

Many of the BPA buildings were built prior to 1970, and some are known to contain asbestos. Asbestos has been found in insulating materials, wall composition and lathing, exterior siding and transite, and floor tiles and mastic. Although some asbestos has been removed or encapsulated, much remains in the current facilities and structures. A number of the BPA safety managers are trained as asbestos inspectors and can provide assistance to workers and supervisors should they encounter suspected asbestos-containing material (ACM). ACM is removed on a contract basis.

After a brief review of the BPA asbestos program, the Independent Oversight team identified the following concerns:

- Section F of the BPA S&H Handbook requires that “a competent person shall be designated for ALL worksites.” The text in the S&H Handbook infers that the duties of the competent person are not limited to work activities on jobsites where asbestos abatement Class I and II work is being performed, but that the competent person must also be capable of “identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy to eliminate them.” The term “ALL” workplaces emphasized in the S&H Handbook would infer that any place where there is an

active asbestos abatement project or where asbestos may be present would be required to have a designated competent person who meets the training requirements of Section F. It was not clear to the Independent Oversight team whether the BPA Safety Managers were intended to be the designated competent persons. However, some of the Safety Managers have maintained their qualifications as an asbestos inspector but not as an asbestos supervisor, which is a requirement of the S&H Handbook for this position.

- Although asbestos surveys have been performed in a number of the BPA buildings, most surveys were not performed within the past three years, and the survey information is not readily available to workers and their supervisors. Workers and their supervisors (particularly contracted workers) are not always aware that the buildings contain asbestos, nor are they always aware that they are to contact the BPA Safety Office prior to drilling into building walls. Recently, a contractor drilled holes into the walls at a BPA substation and uncovered ACM, leading to potential asbestos contamination of the work areas, unnecessary disruption of work activities, and a need to perform asbestos sampling. Further, the sampling that was performed did not include air sampling for asbestos fibers, which OSHA and the Environmental Protection Agency (EPA) require for clearance sampling.
- A number of buildings are posted as containing asbestos. However, in some cases these postings are misleading and provide incorrect or conflicting information. For example, one sign in the Ross Complex warehouse instructs workers to “contact the Safety Office prior to any drilling, cutting or moving materials,” and another posting in the same building states, “refer to MSDS, BPA Safety & Health Handbook Volume II for personal protective equipment before drilling, punching, breaking or scraping.”

Personal Protective Equipment

Requirements: 29 CFR 1910.132, 1910.134, 1910.137, 1910.138 and 1910.269; APM A-2, E-3, H-1, H-2, J-1, T-1; BPA S&H Handbook Chapter B3).

PPE includes protection for the head, eyes and face, ears, hands, feet, and legs. PPE also includes respiratory protection for inhalation hazards, and protective clothing and eyewear for arc flash potentials.

Workers in the BPA shops and others performing potentially hazardous work (e.g., linemen, chemistry laboratory technicians, machinists, etc.) were observed using PPE, but to varying degrees. As a result of a BPA footwear campaign two years ago, foot protection is now uniform throughout the BPA shops and field locations, and workers observed by the Independent Oversight team in the shops and in the field were wearing safety footwear (safety shoes) to protect against falling or rolling objects, sharp objects, and wet or slippery surfaces. Requirements for safety glasses are stenciled on the floors of the large BPA shops (e.g., General Shops). BPA also provides workers with PPE to be worn as workers deem necessary, including molded ear plugs, safety and prescription safety glasses, fall protection harnesses, respirators, and protective chemical gloves.

The Independent Oversight team identified and observed the following concerns with respect to the BPA PPE program:

- OSHA requires that a hazard analysis be performed and documented to support the use of PPE. The BPA S&H Handbook requires that this analysis be captured and discussed as part of all J-1 pre-job briefings for all work activities requiring the use of PPE. However, such a documented hazard analysis, sufficient to support the use of PPE that is worn, is rarely performed in shops or for field work. Within the shops, the J-1 form is seldom completed and used prior to commencing work.
- Based on Independent Oversight’s observations at BPA shops and in the field, the use of some types of PPE is often up to the employee. As noted, PPE use is not based on a documented hazard analysis,

and supervisors sometimes do not provide instructions for such PPE as respirators and respirator cartridges, chemical protective gloves, hearing protection, and face shields. Several supervisors indicated that the use of hearing protection in noisy areas is “up to the employee.”

- The BPA practice of leaving some PPE decisions to employees does not ensure that the PPE selected is appropriate for the hazards as required by OSHA. The Independent Oversight team observed that some PPE in use was inappropriate for the hazard (e.g. respirators, respirator cartridges, chemical protective gloves).

In addition to these concerns, the Independent Oversight team identified other instances where PPE practices did not meet requirements because of weaknesses in safety programs (e.g., hearing protection, respirators). These concerns are discussed in the applicable subsection of this appendix and are not repeated here.

Ergonomics

Requirements: BPA S&H Manual Chapter 16. BPA Manual Chapter 183.

Many workers at BPA are subject to a variety of ergonomic hazards, including lifting, working in awkward positions, and standing for long periods of time. Several of the shop supervisors noted that ergonomic issues are of concern, particularly with an aging workforce.

Although there are no specific OSHA regulations for ergonomic hazards, BPA has developed and implemented an ergonomics program for its workers (Chapter 16 of the BPA S&H Handbook), although the focus is limited to office ergonomics concerns. Chapter 183 of the BPA Manual also addresses elements of the BPA ergonomics program. Independent Oversight’s field observations and interviews indicated that the implementation of the BPA ergonomics program has improved ergonomic work conditions in a number of work areas (e.g., panel lifting and positioning devices and ergonomic tool crimpers in the BPA Ross Switchboard Shop; elevated work tables in the Ross warehouse).

However, the Independent Oversight team observed that most of the identified roles and responsibilities described in the BPA Manual are not being implemented. Furthermore, the BPA ergonomics program is mostly reactive to worker complaints, and is not proactive in identifying and correcting ergonomic hazards based on a systematic hazard analysis.

Ventilation

Requirements: 29 CFR 1910.94, ANSI/AIHA Z9.5 National Standard for Laboratory Ventilation.

Room and building ventilation systems are used in BPA shops to minimize or eliminate airborne contaminants, and local ventilation systems are also used to eliminate localized airborne contaminants (e.g., welding fumes). Many of the shop machines that produce dusts, as well as shop welding stations, are provided with local exhaust ventilation systems. For example, most of the dust-generating woodworking equipment in the Ross carpenter shop is provided with ventilation trunks attached to a central vacuum system. In addition, each of the welding locations within the Ross machine shop is equipped with an adjustable trunk ventilation system. Ventilation systems are also installed in the Ross paint shop for paint booths and bead blasting.

The Independent Oversight team noted the following concerns with BPA ventilation systems:

- A number of laboratory hoods are routinely used within the BPA Chemistry labs within the Ross Complex to minimize worker exposures to chemical vapors and mists. In 2007, OSHA cited BPA for not having measured the face velocity on one of the hoods to determine whether the hood was

operating within the limits prescribed by ANSI standards for such hoods (i.e., 80 fpm to 120 fpm). BPA abated the violation within 90 days, but the hood has not been tested since the original OSHA infraction in 2007; ANSI standards require annual testing of chemical fume hoods. In addition, none of the other laboratory hoods within the BPA Chemistry labs have been tested, and their hood face ventilation flow rates are unknown. Observations by the Independent Oversight team suggested that some of the hoods are not being operated consistent with ANSI Z9.5 and OSHA requirements.

- Most of the Ross Complex Chemistry lab hoods have built-in flow monitoring systems. However, those systems have not been calibrated, their alarm limits are generally unknown by the laboratory chemists, and most alarms are constantly in a “low flow” alarm condition without being evaluated.
- One room in the Ross Complex Chemistry lab is designated for flammables and has a carbon dioxide deluge system designed to activate in case of a fire. However, there are no warning postings and no emergency evacuation plan for the room if the system inadvertently discharges when workers are in the room. The chemists were unaware of a previous accident at the DOE Idaho National Laboratory, in which a carbon dioxide deluge system inadvertently discharged during routine maintenance activities, resulting in one fatality and several severe injuries.
- The room ventilation for the flammable storage area within the Ross Complex Chemistry lab is not effective in some areas. It is designed to ventilate only the upper elevations of the room and would not sufficiently protect workers from exposure to lower-lying gases.
- To obtain credible results for the analytical work performed within the Ross Complex Chemistry lab, the air quality within the rooms during analysis must be maintained at a cleanliness level that will not contaminate the analytical results. However, the Independent Oversight team observed areas near the ventilation supply ducts and analysis equipment that was covered with an unknown black substance.
- A carbon monoxide monitoring system has been installed in the Ross garage to monitor carbon monoxide emissions from vehicles. However, interviews indicated that workers and supervisors do not have sufficient understanding of the carbon monoxide system operation, alarm set points, or actions to take if the alarms actuate.

Material Handling and Storage

Requirements: OSHA Subpart N, APM.

Workers in the BPA shops make considerable use of material handling equipment (e.g., forklifts), cranes, and hoists, as well as slings and chains used to move materials. In general, housekeeping is good throughout the shops.

However, some concerns were identified or observed by the Independent Oversight team:

- BPA provides formal industrial training to fork lift operators. Training content is well documented in a student manual, and 12 to 14 BPA craft have been through a fork lift vendor “train-the-trainer” class and have become certified as fork lift trainers. Fork lift instruction varies in length from 4 to 6 hours, and includes a practical factors student demonstration and written exam. However, several concerns were noted:
 - Other than a brief statement in the substation maintenance guide, “Operation of Fork Lifts,” there are no requirements for fork truck training in either the BPA Safety Manual or the APM. However, the substation maintenance guide applies only to fork lift operations within the Substation Maintenance group, and most of the fork lift users are in other BPA groups.
 - Supervisors are responsible for ensuring that their fork lift operators are certified. However, the requirements for certification and re-certification are not documented or communicated to the BPA supervisors, since there is no documented BPA-wide fork lift program.
 - OSHA requires an inspection of forklifts prior to each use. BPA training enforces this requirement and provides the student with an inspection sheet to satisfy the requirement.

However, there are no requirements in either the BPA Safety Manual or the APM for performing fork lift inspections or documenting them on a checklist, and such inspections are not performed in some groups (e.g., BPA Loan Pool).

- BPA has not established documented requirements for materials handling equipment, nor are there any programs for daily, pre-use, or annual equipment inspections (e.g., for slings and wire harnesses) as required by OSHA. For slings, workers who were interviewed indicate that they inspect the slings before use, but workers have not received training on sling inspections. BPA does not provide any documented requirements or guidance for performing sling inspections other than a brief mention in the APM and within the Transmission Group Work Practices. In addition, OSHA and the APM require an annual inspection of slings by a competent person. However, there is no record or tags on slings indicating that these inspections are performed, nor are there any documented BPA requirements for annual sling inspections. Furthermore, BPA does not define who may be considered a competent person with regard to sling inspections.

Welding, Cutting, and Brazing

Requirements: OSHA Subpart Q, APM.

Welding, brazing, or cutting operations are performed in some BPA shops (e.g., Ross machine shop, Ross small equipment shop, and the various district shops) and in the field by linemen and other workers. The welding area within the Ross Complex machine shop is appropriately designed for welding and is equipped with local adjustable ventilation stations for each welder. Combustibles have been removed, and fire extinguishers and welding curtains are provided.

However, in other locations where welding, cutting, or brazing is performed, the Independent Oversight team identified a number of concerns:

- Although there are a considerable number of OSHA welding requirements, the only reference to welding in the BPA requirements is a brief mention in the APM (four sentences). Welding, cutting, and brazing are not addressed in the BPA S&H Handbook. BPA does not have a hot work permit program, which most DOE sites have implemented to identify hazards and controls for work activities that require welding, cutting, or brazing.
- Workers performing welding activities have not been adequately monitored to determine their exposures to airborne metals and welding fumes, including welding on stainless steel, carbon steel, aluminum, and copper. According to BPA personnel, several years ago the BPA Safety Office contracted an industrial hygiene firm to monitor welding fumes (hexavalent chromium) during stainless steel welding; the BPA Safety Office staff could not locate any records of this effort.
- Although local ventilation exhaust systems are provided in some of the BPA shop welding stations, there is no program for testing local ventilation systems, and no training is provided to workers to ensure that they use such systems effectively. At present, there is no basis for determining whether the local ventilation systems are effective in removing airborne metals and welding fumes from a worker's breathing zone, or whether workers are being overexposed to these airborne contaminants.
- According to the foreman of the sheet metal shop, beryllium was present in the copper used in some copper stock a number of years ago (but that stock might no longer be in use). BPA currently has a considerable amount of copper stock in the sheet metal and machine shops. However, MSDSs could not be located for these materials, and the warehouse could not trace the material composition. Therefore, the beryllium content of the stock is unknown, and BPA cannot ensure that workers are not exposed to beryllium during welding, cutting, grinding, or brazing operations. Potential exposure to beryllium hazards is of concern at many DOE sites, and its use and hazard controls are highly regulated though detailed requirements set forth in 10 CFR 850 and OSHA requirements. However,

the workers and supervisors at BPA were not aware of the hazards and regulations associated with the use of beryllium alloys.

Machinery and Machine Guarding

Requirements: OSHA Subpart O.

The BPA shops in the BPA districts use many types of machinery to perform typical work activities. Machinery includes drill presses, table and rip saws, shear presses, punches, grinders, lathes, and a variety of portable hand equipment. For new equipment, some shops (e.g., Ross machine shop) have contracted with the vendor to provide training for their employees. New machine shop equipment is typically provided with machine guarding, and many of the older machine shop equipment items have been retrofitted with machine guards.

However, Independent Oversight identified or observed some specific concerns with respect to machine shop equipment use:

- Although numerous OSHA requirements apply to use of this equipment, and BPA has received a number of OSHA citations for machine guarding, BPA does not have a documented program for machinery operation or machine guarding. Some older equipment does not have adequate machine guards.
- There are few documented instructions for the use of machine shop equipment and no documented hazard analyses that identify the hazards and controls applicable to use of machine shop equipment. Some of the newer equipment items have operating manuals, but many of the older equipment items have no instructions or operating manuals.
- BPA provides no formal instruction or training on machine shop equipment to BPA employees or supplemental labor contractors.
- None of the shops provide an operator qualification program for use of this equipment. The BPA Fleet Management Services Group (i.e., Ross garage) is considering the development of a machine operator qualification program, but does not have one at this time.

BPA Safety Incentive and Recognition Program

Requirements: BPA S&H Handbook Chapter G1.

The BPA safe worker recognition program, as described in Chapter G1 of the BPA S&H Handbook, is based solely on an employee's record of accident-free service. In recent years, OSHA has cautioned employers that such a program may encourage non-reporting of injuries and illnesses. There are no BPA programs for providing safety recognition awards to employees for other types of safety recognition, such as for preventing a near miss incident, identifying and/or implementing a safety improvement in the workplace, or achieving other safety accomplishments.

Medical

Requirements: Included in OSHA regulations for asbestos, lead, noise, hazardous materials, cadmium, etc.

The BPA Federal medical workforce includes the Medical Program Manager (MPM), one full time nurse, and one part-time nurse (approximately 10 hours per week). BPA operates three health clinics, which are located at BPA Headquarters (Portland BPA), Ross Complex, and the Van Mall site. The primary purpose of these clinics is to provide an extension of health benefit to BPA Federal workers (e.g., routine

physicals, and emergency medical support). Although the intergovernmental agreement with Federal Occupational Health (an organization within the [U.S. Department of Health and Human Services](#) that provides occupational health and wellness services exclusively to federal employees) allows for medical surveillance evaluations, BPA does not use these services. Instead, BPA has procured a contractor to conduct medical surveillance evaluations in approximately 25 sites throughout the BPA service area. Although the BPA MPM retains the responsibility of administering the contracted services, the authority to administer them has been assigned to non-medical personnel.

There are numerous OSHA medical requirements for workers who are exposed to various physical hazards (e.g., noise) or chemical hazards (asbestos, lead, cadmium, mercury, contaminants in hazardous waste, etc.). OSHA requires such workers to be enrolled and participate in a medical screening and monitoring program.

Independent Oversight's interviews with medical program personnel identified several concerns about the BPA medical program:

- The BPA occupational health program does not have the data and knowledge of BPA workplace hazards that is needed to design and implement an effective medical monitoring and surveillance program. At most DOE sites and other commercial industrial sites, worker exposures to workplace hazards are identified through a rigorous employee job task analysis (EJTA) process whereby all workers, with the assistance of their supervisors and industrial hygiene, document the workplace hazards to which they may be exposed (lead, asbestos, noise, etc.). This data is updated on an annual basis or as work conditions or work assignments change, and the information is provided to the medical organization to identify which medical tests are required and which workers should receive these tests. At BPA there is no comparable EJTA process to provide the medical staff with information concerning workplace hazards and employee exposures to these hazards.
- Another fundamental function of an effective medical surveillance program is to measure, quantify and document worker exposures to these hazards; this function is typically performed by industrial hygienists. BPA lacks the capability to perform an effective exposure monitoring program. BPA recently added a contracted industrial hygienist to provide support, but the benefits of this hire in implementing exposure monitoring have not yet been realized.
- An effective medical surveillance program typically includes a data inventory and record keeping system (typically a computer-based system) that allows the medical provider and industrial hygienist to retrieve, track, and trend medical data based on hazards, exposures, work groups, etc., so they can establish the need for exposure monitoring and refine the medical surveillance program. BPA does not have this capability.
- As a result of the above program gaps, the medical provider can only provide an estimate of the types of medical surveillance programs that may be needed (e.g., hearing conservation, lead, asbestos, mercury, general respiratory, and hazardous waste), and the estimate is not based on accurate and complete knowledge of hazards in the field. BPA workers who may need to be enrolled in these programs are entered based on their work group assignments, with no detailed knowledge of the hazards associated with the work group or workers, and no information about their exposures to these hazards.
- Currently, 22 BPA workers are enrolled in the lead surveillance program, but the medical program has no way to determine whether other BPA workers are exposed to lead and should be enrolled. For example, BPA electricians who may be exposed to lead fumes from soldering are not enrolled, and their exposures have not been determined. Similar concerns apply to other hazards.
- The MPM indicated that numerous workers who are exposed to workplace hazards may not be enrolled in an OSHA-required medical surveillance program. On the other hand, some workers are enrolled in a medical surveillance program but do not need to be enrolled (e.g., hearing conservation).

- BPA routinely audits the BPA occupational medical program but does not review the quality, appropriateness, or effectiveness of the medical services with respect to worker health and medical surveillances. BPA audits of the BPA Occupational Medical Program do not include medical personnel (i.e. occupational nurses or physicians) as an element of the audit team. BPA audits of the BPA Occupational Medical Program do not include medical personnel (i.e., occupational nurses or physicians) as an element of the audit team. The MPM indicated that the audit teams refused to include or consult with occupational health professionals. These refusals are documented in the audit reports.

Radio Frequency

Requirements: BPA APM Section R-4, Work Standard 11-5, and ACGIH.

A number of BPA workers could be exposed to non-ionizing radiation during some of their work activities. Activities at BPA include operating a network of microwave, UHF, and VHF radio communications in support of the mission; providing towers to television and wireless communication providers; and conducting tests at various high voltage labs.

The Independent Oversight team observed the following concerns with respect to BPA radio frequency protection practices:

- BPA APM Section R-4 and Work Standard 11-5 establish requirements for using industry standards, including determination of safe working distances and use of personal radio frequency exposure meters (alarming dosimeters) to attempt to keep exposures below the maximum permissible levels. However, these documents do not address standards and TLVs established by ACGIH.
- BPA Work Standard 11-5 provides personal safety guidance with respect to radio frequency exposure hazards and controls for BPA communications antennas. However, BPA has no industrial hygiene monitoring data for employees who work on towers or near communication equipment that generates radio frequency fields, or who work in shops where radio frequency fields could be generated during high voltage testing. Such monitoring is normally used to assess workers' exposures, including potential overexposures.

Cable Splicing

Requirements: BPA Substation Construction Specifications, Appendix O, Cable Splice Guidance.

BPA workers have raised concerns about the safety and reliability of a proposed new cable splice technique specified in BPA's Appendix O, Cable Splice Guidance and the non-lead sheathed splices made by contractors. Ensuring the reliability of the cable shield safety function is a particular area of worker concern.

BPA frequently splices additional conductors to existing substation lead or polyvinyl sheathed and copper shielded low voltage power and control cables to support substation modifications. Historically, BPA splicers have used a lead sheath splicing technique that BPA would like to stop using due to the potential health hazards of lead metal and fume exposure and the need for highly skilled craftsmen to make reliable splices. The workers' principal concern about the proposed new cable splicing technique is that it may not ensure an acceptable level of cable copper shield conductivity and reliability. The cable copper shield is intended to mitigate the voltage and currents induced in the shielded inner conductors due to rapid changes in current or charging of overhead high voltage transmission lines resulting from lightning, switching, or faults. BPA policy requires grounding of these cable shields at both ends to form the required conductive loop through the substation ground mat necessary to provide the desired mitigation. Without a functional grounded cable shield, substation equipment and maintenance personnel could be

subject to significant voltages induced by transients in overhead transmission lines.

Based on a review of the results of BPA testing designed to qualify the proposed new splice technique to be described in a revised Appendix O, as documented in BPA Test Report “Test-13-133,” the Independent Oversight team made the following observations:

- There is no national standard for qualifying low voltage shielded cable splices.
- BPA made four poly cable splices of slightly different BPA Appendix O configurations for comparison to a lead sheathed cable splice and a section of virgin cable.
- The tests that were performed did not attempt to determine whether the completed splices could withstand cable pulling stresses that might be encountered during installation.
- The tests that were performed also did not demonstrate that safe and reliable Appendix O splices can be made on the lead sheathed cables still found in BPA systems.
- The lead sheathed cable splice sample was not subjected to the salt water submergence test, and it is not clear whether it would have passed or failed.
- The H lugs used in the polyvinyl sheath cable splices have sharp edges. Based on industry best practices, the Independent Oversight team concluded that the tapes used in constructing the splice joints do not ensure long-term splice reliability. The “fusible rubber lug wrap” and “88 tape” insulation used in the first passes over the H lugs lack adequate resistance to piercing by the lug edges necessary to mitigate the concern that flexing the spliced cable may lead to compromising the cable splice insulation.
- After reviewing, the results of four Appendix O-like splices and the one lead sheathed splice, the Independent Oversight team concluded that the shield and conductor continuity, insulation resistance, and transfer impedance are acceptable, as necessary to ensure safety when compared to the same attributes of the virgin cable.
- Only one of the four Appendix O-like cable splices passed the planned salt water submergence test; however, even this Appendix O-like cable splice sample reportedly failed during extension of the salt water submergence test well beyond the originally planned test interval.
- The current Appendix O and qualification training do not incorporate the lessons learned from assembling cable splice samples and the needed change in splicing tape to ensure that electricians can repeatedly make safe and reliable splices on poly cable.
- The tests also demonstrated that existing Appendix O cable splices do not ensure safety and reliability because of the now-recognized deficiencies in the current Appendix O procedure. Efforts are under way to identify the location of suspect cable splices and develop a prioritized schedule and processes for needed repair.
- BPA is reportedly considering the following alternatives to resolve the cable splicing safety concerns: (1) continue efforts to qualify a new cable splice technique; (2) work with manufacturers to select qualified cable splice kits for polyvinyl and lead sheathed cable splicing and supplement those procedures where required to satisfy BPA requirements; or (3) remove the need to make cable splices by routing new cable to new termination sub-panels.

APPENDIX C

BPA Work Planning and Control

This appendix provides the Independent Oversight team's evaluation of weaknesses in BPA work planning and control that were identified and/or observed by the Independent Oversight team while reviewing selected work activities performed by BPA employees or supplemental workers. The results are divided into four phases of work planning: work scopes, hazard identification and analysis, development of controls, and performance of work. These steps are typical in any work control process such as the "plan, act, check" cycle or the core functions of safety management. Most of the examples cited in this Appendix are based on observations at BPA field locations. The information in this appendix is used to support the Independent Oversight evaluation of BPA safety management performance in the main report.

Work Scopes

The scope of work for BPA work requests (e.g., outage memo or work orders) for field work activities and/or related work in shops is minimally defined for most activities. For work orders or outage memos, work definitions tend to be brief and detail varies with the expectations of the supervisors and workers. Work scope relies heavily on verbal direction of supervisors or is based on dispatch center communication or the experience and expectations of the individual performing the work. Additional work scope documentation was available in a high level outline form for routine preventive maintenance activities; however, use of or reference to these documents was not observed in the field. Work orders for larger jobs, such as construction or large projects performed in the BPA shops, may contain more detailed work descriptions, typically in the form of drawings. For work evolutions requiring the integration of maintenance crafts with construction or line crew staff members, additional information may be required for coordination and to safely perform the work.

Each of the district BPA shops has methods for scheduling and planning their work activities. Most work planning and control processes are basic and consist of a BPA customer contacting the shop supervisor and initiating a work order with applicable drawings and attachments that describe the work to be performed. Specific concerns about work planning and hazard controls in district shops identified by the Independent Oversight team included:

- There are no documented BPA work control processes for BPA shops, and the existing work processes typically do not routinely involve the BPA Safety Office in the identification of hazards or the planning or execution of work.
- The only formal mechanism for hazard identification is the J-1 process used at the pre-job briefings. Although required by the APM, most shops do not complete the J-1 form as part of their daily pre-job briefing. Some shop foremen use the J-1 form in their morning craft meetings, but most do not.
- In several of the BPA shops (Small Equipment Shop, Plumbers Shop, Carpenter Shop), one individual may work alone. BPA does not have supplemental controls to ensure that individuals who are working alone are subject to supervisor checks and can call for assistance if an emergency arises.

Hazard Identification and Analysis Processes

A number of hazards associated with BPA shops, and substation and transmission line site maintenance activities have not been adequately analyzed or controlled. The J-1 process contains a section titled "hazard analysis" that serves as a good confirmation of readiness to perform work (i.e., it provides a good mechanism for reviewing the activities and location to ensure that previously identified hazards and controls are still sufficient). However, the J-1 process is not an adequate substitute for a formal pre-

planned JHA.

The Independent Oversight team observed numerous examples of inadequate hazard identification and analysis. Hazards associated with chemicals or toxic metals have not been fully analyzed. Inadequacies in the laboratory chemical hood ventilation systems have not been analyzed. Shop workers are routinely exposed to noise so loud, in some cases, that normal speech is difficult to understand, but noise exposure monitoring has not been conducted, and most of the noisy areas are not posted as requiring hearing protection.

Development and Implementation of Hazard Controls

Examples of work activities where hazards were not adequately analyzed or hazard controls were observed to be insufficiently established include:

- Machine tools in several areas are improperly anchored and improperly guarded, with inadequate or missing “point-of-operation” guards.
- Some eyewash stations and fountains in maintenance shops and equipment rooms are in disrepair and have not been maintained to meet OSHA requirements.
- Key controls for administrative locks used at the substations and control rooms reviewed were not secured with a positive control (e.g., within a lockbox). The keys are, however, kept within a control room key cabinet, and access to the control room is limited.
- Maintenance crew applying grease to harp and blade components were observed applying grease with bare hands. When this practice was brought to the attention of an accompanying safety manager and foreman, the MSDS was obtained. The BPA Safety Manager noted that PPE was not required, but on further evaluation by the Independent Oversight team member it was noted that the MSDS indicates that PPE is not required “under normal use” (possibly intending use with a grease gun) and that one of the MSDS precautions advises individuals to avoid skin contact.
- During actuation of breakers during maintenance, the impact noise levels were quite high. No posting for hearing protection was evident, the J-1 made no reference to noise, and only one of the workers in the immediate area had donned hearing protection.
- Construction work (digging and trenching) within the Ostrander switchyard indicated that several abandoned conduit lines had been disturbed. When asked, the foreman indicated that no line location by ground penetrating radar was required or conducted, but that drawings were referenced and the excavator operator “used a light hand.”
- For the Ostrander switchyard work, no ground mat could be identified even though the excavation was in close proximity to the new SF₆ circuit breakers. A later follow-up with a BPA grounding SME identified a ground line (copper multi-strand) that the drawing for the ground mat layout showed as running across the trench area. However, this line was either missing or cut, since it was not visible to the Independent Oversight team and ends of stranded line were observed protruding from the ground in the vicinity.
- The Chehalis Substation shop had a band saw/milling machine available for use without appropriate guarding and/or emergency disconnect, and showed evidence that hot work had been conducted (cutting, burning, grinding or welding) without appropriate designated hot work areas or controls.
- Independent Oversight observed work within and adjacent to the BPA 500 kV switchyard at the Pacific Corp. Energy Chehalis Power Plant, including work performed by the BPA Chehalis and Olympia line crews and the Olympia substation maintenance crew. A maintenance crew welder was observed conducting cutting, grinding, and welding without an assigned fire watch, and welding was also conducted from an aerial bucket truck on a Jack Bus, again without an assigned fire watch or fire extinguisher within the bucket or immediate area. Workers assigned tasks assisting the overhead welding (i.e., manipulating the bucket and holding the Jack Bus) were not provided appropriate eye PPE for welding flash and were instructed to look away.

- At the Covington shops, a number of concerns were noted. The individual working in the heavy equipment shop works alone and conducts oxyacetylene, stick, and metal-inert gas (MIG) welding as well as plasma cutting, without any type of designated hot work area or established controls. Welding was also conducted in close proximity to a painting area, all with minimal ventilation. Hoods in the area had no indication of flow rates or when the last inspection had been performed to ensure appropriate use. No posting of hearing protection requirements was evident, even though impact wrenches and other equipment used for heavy equipment maintenance may generate high noise levels. Numerous pieces of shop equipment lacked emergency disconnects, or the emergency disconnects were obstructed. The shop had generally poor housekeeping and was in disarray, with metal shavings on grinder, milling machines, drill presses and band saws indicating some level of recent use.
- The Covington Substation maintenance shop had an eyewash station and a crane available for use, both of which were beyond their inspection intervals (the eyewash inspection was due in July 2013 and the crane inspection was due May 2013). This shop also had a painting area but had no specific information available about the ventilation capacity or last inspection. Furthermore, the on/off switch for the ventilation system was controlled with a vise grip instead of a knob.
- In a testing shop at the Covington location, testing equipment that had been recently used (as indicated by records next to the equipment) was rated for 460 and 230 volt, appeared to be made locally, and had no Underwriters Laboratory or Nationally Recognized Testing Laboratory certification or marking. Ribbon heaters in the same area were left unattended, turned on, and emitting heat in close proximity to oil samples.
- Workers generally indicated that they could and would stop work if they had a safety concern, but some indicated that whether they would feel comfortable stopping work would depend on who they had as their supervisor. For example, one worker stated, “Today I would, but with some supervisors it would be held against me.”
- One supervisor indicated that additional processes, (such as 100% fall protection or fire watch) could enhance safety, but also stated, “However, BPA needs to understand it will impact productivity, or we will need additional crews.”
- Ostrander substation had three portable protective grounds in use without the appropriate tape to indicate that inspections had been performed as required within the specified interval.
- Tunnels in use at Ostrander (running under the substation) and other tunnels within the BPA system (e.g., for cable runs) have limited access and egress (actual entry doors are over 100 feet apart and around a corner, making them difficult to locate if lighting is lost). Additionally, many lights throughout the tunnels were burnt out (potentially falling below the OSHA minimum lighting standards), and several ladders had been removed as part of a security initiative. These tunnels have not been identified as non-permit required confined spaces, and when lead splicing and other hazards or hazardous materials are introduced, they may become permit-required confined spaces.
- At the Keeler district sub-maintenance shops, the electrical outlets were adjacent to the parts washer but no ground fault circuit interrupter (GFCI) grounding was provided. Propane torches apparently used for thawing equipment in the field were lying in the bed of a four-wheel off road vehicle, unsecured and unprotected from damage. General housekeeping in some shop areas was lacking.
- At the Chemawa Operations and Maintenance Headquarters, a number of fire extinguishers and gas cylinders for SF₆, nitrogen, and cutting gases were inadequately restrained (e.g., held by rope or bungee cords, or no restraint observed). Numerous cutting, burning, and welding units were available for use in a number of shops, but no hot work designated areas or controls were established. Soldering stations were observed to use solder containing lead, but there was no hazard analysis of the potential lead fume hazard. One drill press was unguarded and showed signs of use, such as metal turnings. Eyewash stations were out of required refill (for self-contained units), beyond the inspection interval for fixed units, and/or lacking deluge capability. The heavy equipment shop had no carbon monoxide monitoring, and local ventilation systems were not tested for sufficient flow rate.

In some cases, workers work alone without safeguards to ensure that they can be contacted in case of an emergency (e.g., the heavy equipment mechanic works alone while performing welding and cutting using torches and wire).

Performance of Work within Controls

With some exceptions, the Independent Oversight team observed that BPA Substation Operations, Substation Maintenance, and Transmission Line Maintenance workers skillfully and safely performed routine work activities. Observed work activities included work performed by Ross and Keeler substation operations and maintenance; Chehalis, Olympia, and Covington transmission line maintenance; and Ostrander BPA construction. Specific work activities observed by the Independent Oversight team that were performed safely included:

- Developing, obtaining dispatcher approval, and implementing switching orders to effectively de-energize substation and transmission line equipment to support planned substation switchyard maintenance activities.
- Transferring approved clearances to designated maintenance foreman clearance holders.
- Assisting clearance holders in verifying and ensuring that maintenance crews understood the limits of their clearance and which equipment at the clearance boundaries remained energized.
- Conducting required job briefings of all the workers, supervisors, and observers at the job site.
- Verifying that the equipment required to be de-energized to support safe planned maintenance activities was de-energized before hanging grounding leads.
- Grounding trucks within the work area to grounding cluster conductors attached to appropriate transmission tower conductive surfaces or extensions of the substation ground mat.
- Verifying appropriate step and touch voltage potential at the site of planned transmission line maintenance.
- Ensuring that boom truck outriggers were supported by cribbing on frozen ground that could thaw.
- Using appropriate fall protection equipment while working from elevated buckets on boom trucks.
- Selecting and using appropriate rigging equipment to support transmission lines while replacing insulator strings and lowering and lifting insulator string segments.
- Running new control power cables in the substation cable tray tunnel to support operation of new SF₆ circuit breakers.
- Measuring, cutting, and attaching crimped termination hardware, rigging, lifting and attaching insulating strings and cables to structural supports, and using bucket cranes to facilitate worker access to aloft work areas.
- Operating disconnects and circuit breakers in support of scheduled corrective and preventive maintenance activities.

While many BPA work activities observed by the Independent Oversight team were conducted safely and in accordance with established requirements or controls, some activities were observed being conducted outside of the boundaries of BPA accepted practices. Examples include:

- The voltage checker used to confirm the absence of voltage within the limits of the clearance prior to grounding at the Ross substation was beyond the required two-year calibration interval. The non-conforming test equipment was not noted by the workers, who would have proceeded with the planned activity if not questioned by the Independent Oversight team reviewer.
- Portable protective grounds at multiple locations were noted as being out of the use/inspection date specified by APM requirements (colors noted were white, green, blue, and none). Further, the Chehalis transmission line crew did not initially establish all the required grounds on their limits of clearance, incorrectly intending to rely on air gaps and grounds controlled by the substation maintenance crew within the substation switchyard; this was self-reported as an APM violation and near-hit.

- The Chehalis foreman did not perform a step-and-touch test on the roadway between the various trucks and grounded equipment where his crew worked because he assumed that substation rules applied to the gravel road they were working on, and also assumed that the substation ground mat extended under the road and the transformer next to the generation station. The status of the ground mats in this location and the grounding rules that are required were a matter of debate among the BPA personnel present. Follow-up with a grounding SME and review of drawings determined that the grounding mat did not extend across the roadway, and that the step-and-touch process would be expected to be performed to determine the voltage potential between the roadway and the grounded trucks, and thus the hazard to workers on the roadway.
- Some eyewash stations are not routinely tested as specified by ANSI Z 358.1 to ensure that they will function as required. Some eyewash bottles may be outdated, and some are improperly staged as permanent equipment, contrary to the guidance in the ANSI standard.
- Keeler maintenance crew affixed grounds to the tower and vehicles positioned within the substation switchyard before demonstrating readiness to perform work through their job briefing. Additionally, the crew tested for negative voltage using a voltage checker that was out of calibration. The Independent Oversight team called the foreman's attention to this condition, and the test was conducted again with another unit. While the J-1 required a safety watch for elevated work, at some times all individuals were conducting grounding or testing while other individuals were working at elevation.
- A substation maintenance member maintained contact with a Jack Bus conductor while a second individual was welding the Jack Bus to its support saddle. The Jack Bus was not electrically bonded to the support saddle, as required.

APPENDIX D

Contracted Work Safety and Health Performance

This appendix provides the Independent Oversight team's observations of contracted work performed by construction contractors and vegetation control contractors, as well as background information and general observations on BPA contract mechanisms and processes. It then identifies positive aspects and weaknesses that were identified and/or observed by the Independent Oversight team while reviewing work activities at the following six job sites:

- Franklin Substation
- Transmission Right-of-Way Vegetation Management, Kennewick, Washington
- McNary Substation Upgrade Project, Umatilla, Oregon
- BPA McNary Maintenance Headquarters, Umatilla, Oregon
- Munro Scheduling Center Project, Mead, Washington
- Personal Communication System (PCS) Antenna Replacement on a BPA Transmission Tower.

This appendix also discusses lessons learned from the July 2013 fatal high voltage accident involving a construction company.

General Observations on BPA Contract Mechanisms and Processes

Various BPA organizational elements are involved in managing and overseeing contracted work. Recognizing the significant increase in contracted work, BPA established a Transmission Contract Management Office (CMO), and the Construction Management and Inspection group expanded its inspection force through supplemental labor and additional inspection services through a contractor. Other organizations involved in safety oversight of contracted work include the Safety Office, the BPA Supply Chain Office, and the Transmission/Engineering Offices.

Contract Mechanisms. Contract management is provided through the Supply Chain Office, which includes the Contract Management Group and the Sourcing Services Group. The Contract Management Group provides contracting support to the Construction Management Office for transmission line and substation projects over \$1M. The Sourcing Services Group provides support for traditional contracts (facilities, etc.), as well as Construction and Maintenance Services group contracts that are less than \$1M and performed inside the substations. According to discussions with the contracting officers, BPA uses a Contract Decision Team to determine whether work should be performed by in-house construction resources or go through Engineering and be contracted out. BPA is not required to follow Federal Acquisition Regulations or Department of Energy Acquisition Regulation requirements, and thus has developed its own set of contract procedures, Bonneville Purchasing Instructions (BPIs). Past safety performance is a factor in the evaluation of bids, and BPA has committed to utilizing ISNetworld, which will maintain safety, insurance, quality and regulatory information on BPA contractors.

BPA uses Master Contracts for a large portion of their contract portfolio. Contractors are pre-screened, including safety performance, to ensure that they can provide the wide variety of services required by each Master Contract. Master Contracts can have multiple work/task releases. A Request for Proposal is issued to the contractor, and includes a statement of work with technical specification and drawings as appropriate. Releases identify which specific tasks are to be performed. The contractor must submit a SSSP, which is reviewed by the Safety Office. Once the SSSP is found to be acceptable, a Notice to Proceed for the specific release is issued. A pre-construction conference is held, and is frequently attended by the Safety Office representative. Currently, seven Master Contracts are in place for transmission project construction services.

Contract Safety Clauses. BPA currently has ten S&H clauses that are included in contracts based on the scope of work. There are separate clauses for such topics as line construction, substation construction, non-electrical contractors, and telecommunications contractors. The selection of the appropriate S&H clause(s) is typically determined by the contracting officer. In at least one instance, the wrong S&H clause was included in the contract, and was identified by the Safety Office through review of the SSSP.

The contract clauses provide stop work authority to the COTR, but no clauses provide workers with stop work authority. In addition, the clauses are inconsistent with regard to the development of SSSPs and/or JHAs, and do not contain clear expectations for what should be included in a contractor's SSSP submittal. This lack of clarity, in part, resulted in poorly developed contractor safety programs, such as programs for control of hazardous energy, fire safety, fall protection, confined spaces, HazCom, and hazard (by task level) analysis, as well as industrial hygiene programs that are used to ensure that occupational exposures for hazardous chemicals and physical agents are monitored and controlled.

The Independent Oversight team found evidence that the BPI S&H clauses flow down to the contractor's SSSP and subcontracts. In its review of SSSPs (discussed later), Independent Oversight identified specific issues that can be attributed to the lack of specificity in the S&H clauses.

The Independent Oversight team reviewed the contract mechanisms addressing the stop work process. The BPI General Contract Administration policies include Clause 14-14 STOP WORK ORDER, which addresses the right of the contracting officer to stop work at any time. BPI Part 14, Environment and Safety, Section 14.12 further addresses suspension and stop work orders, in that the contracting officer, the COTR, or the field inspector may suspend work in the event of safety concerns. All of the S&H clauses contain the provision that the COTR may stop work if the contractor fails to promptly correct an unsafe situation. The draft Contractor Safety and Health Requirements for Prime and Subcontractors document provides additional direction on stop work, directing contractors to inform workers that they have authority to temporarily halt work activity due to imminent danger or safety issues without fear of reprisal.

BPI S&H clauses require a contractor to submit a SSSP if there are recognized or significant job hazards. Independent Oversight reviewed several SSSPs and determined that they had been "cut and pasted" from other contracts, with limited analyses of the specific hazards for the planned work. The BPA Safety Office confirmed that "cut and paste" was a common practice. Since the intent of a SSSP is to identify controls appropriate to the *specific* job site hazards, the copying of information from one plan to another may not identify needed controls for the scope of work and associated hazards the new SSSP needs to address.

Although there is no mandated format, the safety managers have developed recommended templates that are based on the S&H clauses. However, the S&H clauses are inconsistent in that some require the development of a SSSP, some require a SSSP and a JHA for aircraft operations, some give the contractor the option of developing a SSSP or a JHA, and one (vegetation management) requires the development of a JHA.

Most of the S&H clauses contain the requirement to conduct a job briefing prior to the beginning of work each day, and to address safety in the briefing. The S&H clause for non-electrical work at non-BPA facilities (Clause 15-53) does not require a daily briefing.

BPA's General Counsel indicated that BPA is hesitant to tell contractors how to do the work and has been reluctant to insert specific safety requirements or require that BPA safety requirements be followed. However, the Independent Oversight team noted throughout the review that BPA included very specific

requirements from the BPA APM other BPA safety-related documents when they saw fit, on an ad hoc basis. Independent Oversight interviews indicated that some contractors and BPA thought that BPA requirements were being “inspected in” (i.e., cited by inspectors even if not explicitly included in the contract). Several of those interviewed thought that including BPA rules would clarify the safety expectations for their work performance.

The Safety Office indicated that it cannot obtain medical records and training records from the contractors. The Level 1 accident investigation report for the March 2010 equipment (Bobcat/backhoe) fatality included a finding that the supplemental labor contract lacked a mechanism to ensure that the vendor meets the terms of the contract to verify training and certification of supplemental labor employees. Another finding stated that the accident investigation board was not given training records on which to base conclusions about the operator’s qualifications. The Level 1 accident investigation report for the construction company employee high voltage electrical fatality included a recommendation that language be added to the contracts that the BPA medical officer be provided all relevant medical information. A representative from BPA’s General Counsel, however, did not believe that BPA should require medical information because an individual’s medical information or medical records may contain sensitive medical information about the individual that is not needed or is not relevant to the accident investigation.

During interviews and a review of documentation, Independent Oversight determined that the Safety Office’s involvement in the contracting process is limited to post-award activities, such as a review of the SSSP and attendance at the pre-construction meeting. The Safety Office typically is not involved in pre-award activities, such as developing the scope of work, establishing the safety requirements, evaluating past safety performance, or reviewing the request for offer or bids. Also, the Safety Office’s involvement in the contracting process is informal; none of the contracting or safety procedures document the roles and responsibilities of the Safety Office with respect to the contracting process. BPA holds an annual contractor/vendor conference for new or potential contractors, which includes a presentation by the Safety Office. Independent Oversight interviews with the contracting and safety staff indicate that there are opportunities for more prominent involvement by the Safety Office during this conference, such as discussing safety expectations, deliverables, and lessons learned from the previous year.

Flowdown of Work Planning and Control Provisions of Contracts. Independent Oversight reviewed the flowdown of S&H requirements from BPA to their prime contractors and subcontractors. BPA is required by the Occupational Safety and Health Act to follow Federal OSHA standards for Federal workers, and applicable Federal or state OSHA standards for contracted work. OSHA’s construction safety standards apply primarily to BPA’s work. DOE S&H-related directives that BPA is required to follow are listed in an appendix to DOE Delegation Order No. 00-033.00B, *Department of Energy Delegation Order No. 00-033.00B to the Administrator and Chief Executive Officer of Bonneville Power Administration*, July 20, 2009. The only S&H-related DOE directive included in this appendix, and applicable to BPA, is DOE Order 5480.4, *Environmental Protection, Safety and Health Protection Standards*. DOE Order 5480.4 was last updated in 1993 and was cancelled in 2007. Other DOE organizations rely on an updated set of S&H-related DOE directives to develop and maintain their safety management systems and to establish an acceptable set of S&H requirements/standards. BPA has not committed to follow any additional safety-related DOE directives or safety management systems.

As discussed previously, BPA has developed S&H clauses that are included in contracts based on the scope of work. A Request for Proposal is issued to the contractor, and includes a statement of work with technical specification and drawings as appropriate. Releases identify which specific tasks are to be performed. Once the SSSP is found to be acceptable, a Notice to Proceed for the specific release is issued. Pre-construction conferences are held, and are frequently attended by the Safety Office representative.

Typically, the superintendent or general foreman is involved in planning the work, which is resource-loaded and scheduled. A project manager keeps track of project status. In accordance with the S&H clauses, the SSSP must be provided to the employees and a copy kept at the job site. Also, the S&H clauses require a daily job briefing, referred to as J-1 tailboard or tailgate meetings. The superintendent and foreman are in charge of the daily work and provide direction to the work crews.

An important element of work planning and control is the identification of hazards and selection of appropriate controls. For BPA contracted work, this is accomplished primarily through the development of the SSSP and/or JHA. Independent Oversight reviewed contract documents, four SSSPs, and a subcontract document to determine the flowdown of S&H requirements.

Independent Oversight compared the contractor's SSSP for the Franklin Substation Upgrade to the S&H clause for substation construction. The SSSP addressed most of the topics in the S&H clause, with emphasis on the minimum approach distance, grounding and equipotential bonding, cranes, and trenching and excavation. The SSSP also addressed the expectations for a daily job briefing/JHA. However, the SSSP did not address the duties of safety watchers, and its coverage of certain topics (e.g., lockout/tagout, PPE, fire hazards) was superficial. The SSSP considered bees, spiders, etc. to be "environmental hazards," indicating a need to clarify the expectations for this area.

The Munro Scheduling Center Project contractor's SSSP was compared to the S&H clause for non-electrical non-facilities contractors. It was found to address most of the items in the S&H clause but did not address lockout/tagout. This SSSP was tailored to address specific needs at the work site, including the existing microwave tower, concrete forming and placing, and reinforcing steel. The coverage of certain topics in the SSSP was cursory, but the topics were adequately addressed in detailed plans for the pre-task safety analysis (PTSA) form, pre-cast concrete tilt-up accident prevention plan, fall protection work plan, and hot work permit, which were attached to the SSSP.

The contractor for the Munro Scheduling Center Project was also the prime contractor for the McNary Maintenance Headquarters project to construct a general office building and two smaller buildings. The SSSP was compared to the S&H clause for non-electrical contractors and was found to address most items, with the exception of flammable liquids and the duties of safety watchers. The SSSP references an attached site logistics plan, which was not attached. As in the contractor's SSSP for Munro, the coverage of topics in the plan was very limited, but the topics were adequately covered in attached documents (e.g., fall protection work plan and hot work permit plans).

The Franklin Substation Upgrade Project contractor was the contractor performing the work to replace the antennas on transmission towers at Bonneville. Independent Oversight compared the SSSP to the S&H clause for telecommunications contractors. In general, this SSSP is of very poor quality; because of numerous grammatical and spelling errors, several of the sentences do not make sense. The SSSP addresses hazards specific to this job, including radio frequency radiation fields, communication with towers, rigging, and fall protection. However, safety watcher duties were not addressed.

The contractors stated that they rely on their own procedures for performing work, unless the work involves a specific BPA process, such as clearances. According to interviews with the superintendents and workers, most of the work was performed by qualified workers, was considered skill of the craft, and did not require the use of procedures. As noted above, some of the work is addressed by permits and documented plans.

BPA Oversight of Contracted Work. Organizations that provide some level of safety oversight of contracted work include: the Safety Office, which includes 2 FTEs for contract safety, and 4 district

safety managers covering the 13 districts; contracting officers from the BPA Supply Chain Office; COTRs from the Transmission/Engineering Offices; and Construction Management and Inspection group QA representatives and field inspectors.

The Safety Office has two individuals dedicated to contracted work. One individual is a BPA employee who handles CMO contracts for high voltage work. The other is a supplemental labor employee who handles non-CMO contracts for non-electrical work. The BPA employee has extensive experience in the electrical construction field, has been a safety and occupational health manager for 15 years (the last 2.5 years as a safety and occupational health manager with contractor safety oversight responsibilities), has received an OSHA certificate for Safety and Health for Construction and General Industry, and is a Certified Utility Safety Professional through the Utility Safety and Operations Leadership Network. The Contractor FTE has a program and project management background with the General Services Administration and the Army. Both individuals indicated that they spend a large amount of their time reviewing the SSSPs but spend little time in the field. The amount of time spent in the field was restricted by the amount of time spent reviewing SSSPs and one individual noted that they sometimes received the SSSPs for non CMO projects on a Friday when the work is supposed to begin on the following Monday. These individuals indicated that the Safety Office typically needs ten days to properly review and resolve comments with the contractor and that the often short times for review are inadequate. One of these individuals indicated that he reviewed 280 SSSP/JHAs in fiscal year (FY) 2013, and provided safety oversight of contracted work in the field approximately 15 times. The other individual noted the last year was devoted to other special projects (e.g., Safety Clause revisions and ISNetwork implementation) in addition to her contractor oversight duties.

The safety oversight staff has a goal to conduct six site oversight visits per month. BPA safety, however, does not maintain a safety inspection/assessment scheduling tool to help target the field activities and to ensure that field oversight expectations are met. BPA district safety managers are primarily responsible for safety of BPA self-performed work and provide little safety oversight of contracted work.

The Construction Management and Inspection group uses QA representatives and field inspectors, who primarily provide oversight of the contractor's technical, QA, and specification requirements for CMO and some non-CMO work. This group includes BPA FTEs, supplemental labor, and contractor support. There is an informal expectation for the Construction Management and Inspection QA representatives and field inspectors to oversee occupational safety of the contractor work activities, but this expectation is not well defined or communicated. The QA representatives and field inspectors provide daily oversight of the contract jobs, which is documented in the Contractor Administration Information System. The contractor also produces a monthly safety report that includes safety performance statistics for those contractor projects where a contractor oversight person is assigned. The master contract requires their staff to have completed a minimum ten hours of OSHA training and to be able to interpret safety rules and regulation for the states. Also, the contractor has developed training modules for their QA representatives for fiber optics, telecommunications, substation, and transmission line work.

Until three years ago, the Construction and Maintenance Services Group did not contract out work. However, due to the increased amount of work, they now contract out "force account group" small capital project work that cannot be self-performed, and which is less than \$1M and performed inside substations. All contractors are required to submit a SSSP, and a safety watcher is required for electrical work. The COTR and a crew of two BPA electricians and an equipment operator oversee this work, and the Safety Office also performs some oversight. The COTR has experience as a planner/scheduler and was previously a contracting officer. He has received 40 hours of procurement training for performing his COTR duties. However, BPA's Construction and Maintenance Services Group has not established qualification requirements for individuals who oversee the safety of contracted work.

Franklin Substation Upgrade Project

The contractor for this project was contracted to upgrade and expand the substation outdoor equipment and to remove, replace, and upgrade certain racks (substation instrumentation and control equipment) in the Franklin control house. During the Independent Oversight team's observation, a subcontractor was performing work at the site, primarily civil work (trenching, earthmoving, and concrete). The subcontractor also had a fencing subcontractor on site installing a perimeter chain link fence to allow for expansion of the substation's footprint for new equipment, including a capacitor bank.

The superintendent does a morning walkaround to ensure that all workers are ready to do work safely. He also does a weekly site safety review of the work, which is documented on the contractor's Job Site Safety Review form. Three of these documented weekly safety reviews from November 2013 indicate that the review was performed satisfactorily.

The daily job brief by the superintendent was short, describing the hazards of the day's work as "115KV overhead bus (low). Snow/cold temps, open excavations, moving equipment, congested [*sic*] work area, hand tools, loose yard rock, overhead work, work near energized panels." The hazard controls listed for these hazards in the J-1 equivalent form was "Utilize safety watch, proper PPE, use spotters, communicate with operators, keep material below waist, ladder safety, inspect tools, tape wire ends, and training." No individuals were listed as "Qualified Signal Person," "Qualified Rigger Person," or "Certified Crane Operator" on designated places on the daily briefing form, even though the observed work included hoisting and rigging of steel columns with a digger-derrick crane.

The only control listed for the hazard of working near energized equipment in the control house was to "tape wire ends." Other potentially important controls for this work activity that were not documented were barricading the entrance to work areas; applying methods for ensuring that equipment is de-energized; barricading work areas; and, using signage/barricades to prevent workers from inadvertently working on energized "look alike" equipment next to de-energized electrical equipment. While not specified in the SSSP, the Independent Oversight team noted that the work area in the control house was barricaded with caution tape and "look alike" equipment was also taped off to prevent inadvertent work on energized racks.

Other areas that are not fully effective and/or not incorporated in this SSSP are:

- The identified PPE to protect workers from specific hazards beyond the general construction daily PPE (hardhats, steel toe boots, gloves, glasses) did not include hearing protection, face protection, specialty gloves, welding/cutting related PPE, respiratory protection, etc. The subcontractor performing civil work did not have a process (e.g., a daily task-by-task hazard analysis or a detailed hazard type to PPE matrix table) to provide the workers sufficient detail on the specific PPE needed for the task.
- The contractor did not have a procedure to ensure that occupational exposure monitoring for potential hazards (such as silica, lead, cadmium, arsenic, mercury, noise, or exposures to hazardous materials where there are occupational exposure limits established by OSHA and/or ACGIH) is conducted by a qualified industrial hygiene professional or other trained/qualified individual under the supervision of an industrial hygienist. Currently, no corporate industrial hygiene resources are available for day-to-day occupational monitoring. Industrial hygiene monitoring is primarily contracted out now by the contractor, typically when hazardous material abatement activities are needed.
- The contractor did not have processes for ensuring that the MSDS is available as part of the daily briefing, and that workers are trained on the PPE (including the prescribed respiratory protection) identified by the MSDS, and that an appropriate occupational exposure monitoring strategy is in place if required. The current contractor process for obtaining an MSDS is for a worker wanting an MSDS

to call a 1-800 number to request an MSDS from the 3E Company. There is no requirement for the contractor to obtain an MSDS before using hazardous materials (e.g., solvents, paints, and adhesives).

- Requirements for operating mobile equipment safely, such as following the manufacturer's safety/operating manual specific to the equipment being operated are not established. For example, there are no specific requirements for operators of rough terrain forklifts to wear seatbelts and to remain belted within the rollover protection system in the event of a tip-over.
- The Heat Illness Prevention section of the SSSP does not take into account the need for programmatic and monitoring requirements, such as those in the Washington State OSHA requirements and the monitoring program found in the ACGIH TLVs. The ACGIH TLVs are a requirement of DOE Order 5480.4, which is invoked by the *Department of Energy Delegation Order No. 00-033.00B To the Administrator and Chief Executive Officer of Bonneville Power Administration* and by BPA Manual Chapter 180 (Section 180.6.G).
- The Fire Hazards section of the SSSP provides limited fire prevention for construction related sites and for hot work such as welding, grinding, soldering, brazing, and use of open flame equipment. National Fire Protection Association (NFPA) 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, and NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, are the appropriate standards to establish the proper level of fire safety for the work being conducted under this SSSP. NFPA National Fire Codes are requirements of DOE Order 5480.4 and BPA Manual Chapter 188 (Section 188.3.C).
- The Confined Space section of the SSSP does not provide sufficient information to control hazards during confined space entry when needed for the job. Simply indicating that a contractor will adhere to Federal OSHA (1910.146) and/or any applicable State standard or regulations for Confined Space is not adequate to comply with OSHA standards applicable to construction activities. The superintendent of the Franklin Substation Upgrade thought that BPA did not classify work in vaults or underground electrical installation as "confined space," while other construction contractor superintendents interviewed for this review thought that the "confined space" requirements are applicable and indicated that they follow their corporate or BPA confined space procedures. The SSSP is not clear on the methods that superintendents, foremen, and workers should use to identify enclosed or confined spaces and their hazards and for complying with 29 CFR 1926.269(e) and (t) and 1910.146 standards based on a written confined space entry permit program specific to work under the SSSP.
- The Lockout/Tagout section of the SSSP does not identify a written procedure specifying the contractor's methods for implementing the 29 CFR 1910.147 requirements. (Also see discussion below on need for clarity on lockout/tagout implementation at the contractor work site.)

The SSSP for the job was available on site, and the Independent Oversight team spot-checked work activities against SSSP requirements. The Independent Oversight review of the SSSP indicated that most of the safety programs or controls noted are summaries of BPA contract requirements, OSHA safety standards, or contractor corporate safety programs and that the SSSP section typically lacked specific implementation information for workers to fully understand who is responsible; how, when, and how often to accomplish a required control/action; and how to document actions where appropriate. For example, the SSSP section on Adherence to Regulations and Standards states: "Regular crew safety meetings, crew audits, and job hazard analysis will be done to ensure all regulations and standards are being adhered to." Also, based on interviews and documentation provided to the Independent Oversight team, no crew safety audits or JHAs were performed/documented for the observed work. Further, the Lockout/Tagout section of the SSSP indicates that the contractor shall adhere to OSHA 29 CFR 1910.147, *Control of Hazardous Energy*, in one bullet and "per standard Lockout/Tagout procedures" in another bullet. The superintendent said that they actually follow the BPA APM for lockout/tagout. The references to different documents for lockout/tagout requirements could be confusing to workers, could result in conflicting requirements, and do not ensure that workers will be referred to a single

lockout/tagout program (document name and date) that cites all the pertinent responsibilities and lockout/tagout policies and procedures specific to the work and that meets contract and OSHA (Federal or state as appropriate to location) requirements.

There was a discussion with the superintendent about the best set of safety requirements to follow to sufficiently control hazards encountered while working on BPA property (within a substation, in this case). The superintendent did not demonstrate knowledge of the BPA contract safety clauses (although his organization was required to follow the clauses) and noted that BPA would not “officially” issue the BPA APM to him as a contractor, although he had obtained one to use as reference. The superintendent thought that in some cases, BPA contract safety requirements were vague and noted that BPA oversight personnel appear to inspect to BPA safety requirements. The superintendent thought that it would be simpler to apply the BPA safety requirements to the contractor through the contract. He indicated that applying BPA requirements would add much-needed clarity about what safety requirements should be applied and would improve the coordination of work between the BPA and contractor workforces. In general, the Independent Oversight team determined that additional clarity in BPA safety requirement expectations is needed for contracted work.

In a group interview with the contractor lineman and electricians, the workers noted that they do not receive timely feedback information from BPA accident investigation reports to help improve their work practices. They were not familiar with the recent BPA fatality accident investigation results. The lineman/electricians said that they mostly hear rumors about accident causes, rather than the actual causes and corrective actions needed to prevent recurrence of the causes/accidents in the future. With regard to lessons learned from BPA accident investigations, the superintendent indicated that the investigations tend to place too much blame on the worker and do not sufficiently evaluate causal factors involving supervisor/manager actions, inadequate procedures, or other human performance issues that impact safety compliance or performance. The lineman expressed interest in why their company requires 100% fall protection and BPA management has “not seen fit” to require BPA lineman to follow 100% fall protection. The BPA Deputy Safety Manager provided the interview group with insights to the BPA path forward on this fall protection issue.

The contractor indicated that oversight from the BPA safety managers was infrequent. He also noted that safety managers have many contractor sites to oversee.

Transmission Right-of-Way Vegetation Management, Kennewick, Washington

A company was contracted by the BPA under a master contract to perform vegetation control work. The work observed by the Independent Oversight team included identification and removal of trees planted under BPA transmission lines in a suburban park area in Kennewick. The work observed included cutting down trees, trimming branches, and disposing of the downed material by chipping it into mulch. The BPA person from the Pasco District Office who is responsible for vegetation management and clearance of right-of-ways was at the job site during the Independent Oversight team’s observation of the work.

BPA requires a JHA (instead of a SSSP) to be submitted for vegetation management contracts or master agreements. “Job Hazard Analysis Master Agreement 62844-000” was provided to the Independent Oversight team and was used to establish the safety work practices for the work conducted under this contract. This document was not a traditional JHA, which typically identifies worker hazards by job tasks and associated controls for each task or work step. Rather, the document was similar to a traditional safety plan, with some procedural and safety requirements imbedded throughout the document. One good practice noted was that the contractor committed to compliance with a nationally recognized standard, specifically ANSI Standard Safety Z 133.1. The current ANSI Z 133.1-2012 is titled, *Safety Requirements for Arboricultural Operations*.

Contract workers used a chainsaw and portable chipper for this work. Work practices were appropriate, as was the PPE used (hardhat, gloves, boots, long sleeves, hearing protection, safety glasses with side shields, and chaps). Workers appeared to carry tree limbs and trunks cut to a size that did not require excessive exertion. Workers appropriately bent their knees to pick up material from the ground, rather than leaning over and using their back for leverage. The chainsaw was always carried with the chain bar backwards, and the chain brake was observed to be engaged frequently when moving the chainsaw to new positions. Workers were observed standing to the side as they fed material into the chipper. All work was performed at ground level, and there was no possibility of workers or trees violating the Minimum Approach Distance (MAD) for the overhead transmission lines.

The contractor's JHA document indicates that they use a Laser Tech Impulse 200 range finder to ensure they do not violate MAD. No other contractor observed during this review indicated that they used range finder technology to determine distances to energized lines.

McNary Substation Upgrade Project, Umatilla, Oregon

The prime contractor for the Franklin Substation Update Project was also contracted to upgrade and expand the substation outdoor equipment and to remove, replace, and upgrade selected racks (substation instrumentation and control equipment) in the McNary control house. The subcontractor that was performing work at the site during the Independent Oversight team's work observation was primarily performing civil work, such as trenching, earthmoving, carpentry work (e.g., setting forms), and backfill work around completed concrete pads. There was no contracted electrical-related work in the control house at the time of the Independent Oversight team observations.

The Independent Oversight team accompanied the contractor superintendent on a walkthrough of the construction site as contractor and subcontractor workers prepared to start work. The walkthrough started at a lower elevation, where the extension of the existing outdoor substation was being constructed. A sloped area on the side of the existing substation was excavated to create a lower elevation work surface. The excavation created a steep slope from the existing substation down to the lower level work area. The review team asked to have a closer view of excavation work located on the edge of the upper elevated substation. The supervisor led the review team up a sloped path that had loose, rocky soil, and traveled over a path approximately 18-24 inches wide and adjacent to an existing chain link fence that had loose barbed wire protruding over the path. This path was one of the main walkways for workers to travel between the upper-level substation and the lower-level new construction site. This walkway did not meet the SSSP Maintenance of Work Area section requirements, which state: "maintain safety working area free of tripping hazards and hazards that can cause injury. Employees will maintain proper walkways... for all employees working at the job site." The trackhoe used in the backfill work on the elevated substation yard was grounded as required by the SSSP.

The contractor and subcontractor did not provide any evidence that "Regular crew safety meetings, crew audits and job hazard analysis" were performed. These actions are required by the SSSP section on Adherence to Regulations and Standards.

The SSSP areas that need to be improved or added as identified above for the Franklin Substation Upgrade also apply to the McNary Substation Upgrade SSSP.

Regarding the Hazardous Material section of the SSSP, the contractor Safety Coordinator indicated that contractor workers have recently completed the OSHA required training on upcoming changes to the HazCom standard. The Hazardous Material section also requires that "The Safety Department shall evaluate and approve all hazardous materials, chemicals and products." However, neither the

superintendent nor the Safety Coordinator could define hazardous materials that fall under this requirement. The Safety Coordinator could not demonstrate that any such materials were evaluated and approved for the chemicals used on this project.

The Independent Oversight team reviewed the contractor daily job briefing that was completed for the day's work. The checklist of items applicable to the work that day appeared to be missing checks for a number of items/hazards observed while the team was on site, including first aid kits, fire extinguishers, project-jobsite access, equipment inspections, and forklift – loader inspections. Also, the control listed in the daily briefing form for moving and swinging equipment was to use a spotter; however, no spotters were evident while equipment (such as rough-terrain forklift) was moving around the worksite.

BPA McNary Maintenance Headquarters, Umatilla, Oregon

A company was contracted to construct new facilities at the McNary Substation, including buildings for office, maintenance, storage, and hazardous material purposes. Construction on the facilities was approximately 80 percent complete at the time of the Independent Oversight team's observation. Approximately 20 workers from various crafts were installing roofing on the storage building and installing lights, plumbing, and drywall in the office and maintenance buildings. The local electric cooperative utility was contracted directly to BPA to install electrical power to the new facilities and was installing underground conduit adjacent to the new facilities.

The contractor superintendent and the BPA contract oversight person (contracted supplemental employee to BPA) provided a tour of the facilities to the Independent Oversight team. The Independent Oversight team observed work in the afternoon, and did not observe the morning daily briefing.

The Independent Oversight team observed workers wearing the general construction PPE, as prescribed in the SSSP section "PPE." The only other PPE noted in use by the review team was a dust mask used by workers sanding drywall. The Independent Oversight team observed work being performed at height, much of which was performed from manlifts and scissor lifts, precluding the need to work from ladders or scaffolds. No work was conducted that could be close to MAD for energized electrical lines in the construction area.

The Independent Oversight team observed an open trench approximately four feet deep with electrical conduit lying at the bottom of the trench. Workers were near the trench, but no workers were in the trench at the time of the observation. However, the Independent Oversight team noted that no ladder was available to access the trench and that the excavated spoils were placed immediately adjacent to the trench, rather than two feet away from the trench as specified in the OSHA standard. The Independent Oversight team discussed these observations with the BPA Safety Manager. BPA personnel reported that the trench work was being conducted by the local electric cooperative utility and not under the control of BPA's contractor. The local electric cooperative utility promptly abated the trenching safety non-compliances.

The Independent Oversight team observed three workers on an elevated, low-slope roof applying metal roofing to an existing wood deck. The workers were not following either the protection methods outlined in the Fall Protection Plan incorporated into their SSSP or the conventional methods allowed by 29 CFR 1926, Subpart M, *Fall Protection*. Instead, the contractor used a personal fall protection/arrest system in which each worker was attached to a mobile crane hook positioned slightly above their heads as an anchor point for their fall protection equipment. This fall protection method is not specifically addressed in Subpart M; however, §1926.502(k) does allow for employers to develop and use a fall protection plan if they can demonstrate that conventional methods are infeasible or create a greater hazard. Although the method used may be comparable in effectiveness, the contractor Fall Protection Plan for this project did

not meet the OSHA requirements by indicating: 1) reasons why conventional fall protection methods are not feasible; and 2) safety precautions to ensure that the crane provides a stable anchorage point. Possible safety precautions that were not documented include ensuring that controls and brakes on the crane are appropriately locked to ensure no boom or line movement; ensuring that the crane manufacturer design supports the required anchorage specifications in accordance with OSHA standards; and establishing wind limitations, placement of outriggers for stability, positive closure on crane hook, and communication between the workers using fall protection and the crane operator.

The superintendent reported that he performed the daily job briefing. The Independent Oversight team requested but did not receive any daily job briefing forms for this project. The contractor superintendent also indicated that a documented construction walkaround safety inspection and safety meeting was performed weekly by two crew members. The contractor provided a completed form for a November 4, 2013, walkaround and safety meeting, which included signatures of onsite employees from the prime and subcontractor employees on the project. The walkaround documented housekeeping issues around the construction site that were corrected.

The Independent Oversight team's review of the SSSP for this project indicates a number of areas that are not fully effective and/or not incorporated in this SSSP. For example:

- The PPE section only specifies typical construction-related PPE, such as hardhats, vests, safety glasses, hearing protection, gloves and boots. There was no requirement to identify hazards that require additional or specialized PPE to control the identified hazard. The Safety Pre Task Analysis section indicates that a PTSA form was attached to the SSSP (missing from both the hard and electronic copy of the SSSP provided to Independent Oversight) and was to be completed by the competent person on the crew for the scope of work to be performed each day. Site personnel reported that these PTSA forms were not being completed.
- The Safety Pre Task Analysis section requires a PTSA to be completed daily and used by the crew to mitigate specific hazards with each task, including PPE use; however, the hazard analysis is not being conducted, documented, or used to control hazards.
- The Weekly Construction Jobsite Walkaround Safety Inspection and Safety Meeting process appears to be used; however, documentation of the daily job briefings and tailgate meetings was not available.
- The Masonry section indicates that "All dry cutting will be monitored to avoid dust inhalation." However, the Independent Oversight team was informed that no in-house corporate industrial hygiene resources are available to address silica exposures. The section also does not address appropriate control measures when cutting masonry, such as use of local ventilation, wet cutting methods and respiratory protection. Without proper controls or industrial hygiene occupational exposure monitoring, the contractor cannot ensure that exposures are below occupational exposure limits.
- The Fire Hazards section basically indicates that a fire extinguisher will be available at certain locations, such as field offices, equipment, fueling locations, and hot work locations. The SSSP Fire Hazards section does not consider NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*.
- The Hot Work section, along with the Hot Work Permit form attached to the SSSP, appears to follow NFPA 51B and would provide adequate controls to control hot work if fully and correctly implemented. A worker was using a propane torch for soldering within the new office building at the time of the team's observation, but no hot work permit was issued. The superintendent indicated that the hot work permit process has not been followed for this project, but indicated that hot work controls are in place when needed.
- The Fall Protection section and the attached Fall Protection Plan do not cover all of the fall protection methods being used on the site (see discussion above on use of a mobile crane as an anchorage point for fall protection/arrest systems used while roofing). Independent Oversight also noted that this

section indicates that fall protection is covered under Washington State OSHA; however, this project is located in the state of Oregon.

- The Heat Related Stress section only indicates that “Water will be on site for all employees and shade will be provided when temperatures reach over 90 degrees. A heat stress plan will be in place.” No plan was available at the time of the Independent Oversight team’s observation that addressed OSHA and ACGIH programmatic and monitoring requirements.
- The section on Lock Out/Tag Out Procedures simply indicates that an electrical subcontractor will use their lockout/tagout program. Contractor personnel indicated that the electrical subcontractor’s lockout/tagout procedure meets the requirements of 29 CFR 147, *Control of Hazardous Energy*. However, the reliance on one subcontractor’s program does not ensure that all workers on the project are aware of the specific lockout/tagout procedures and methods to protect themselves from hazardous energy sources (including electrical, pressure, mechanical, and other hazardous energies), and understand the locks or tags that are in use to protect other workers.
- The Electrical Safety section states that “No personnel will be allowed to be exposed to unprotected or open electrical hazards” and that “Only qualified personnel will be allowed to work on energized equipment/circuits.” While these declarative statements are appropriate, they do not provide any information on how workers will be made aware of the contractor’s procedures for implementing OSHA and NFPA 70E electrical safety requirements (e.g., developing arc flash calculations, labeling, and PPE procedures). In addition, the section does not recognize that most work can be de-energized when working in new construction electrical installations under 600 volts.
- The SSSP does not include or refer to any procedure to ensure that occupational exposure monitoring for potential hazards (e.g., silica, lead, welding fumes, noise, or exposures to hazardous materials where occupational exposure limits are established by OSHA and/or ACGIH) is conducted by a qualified industrial hygiene professional or other trained/qualified individual under the supervision of an industrial hygienist. Currently, no corporate industrial hygiene resources are available for day-to-day occupational monitoring. Industrial hygiene monitoring is primarily contracted out by the contractor.

The contractor noted that the BPA Construction Safety Manager and District Safety Manager have been on site “a few times” during the project to oversee safety implementation for the project.

Munro Scheduling Center Project, Mead, Washington

A construction company was contracted to construct a new 35,000 square foot addition to the existing Munro Control Center. Most of the steel erection, foundation work, lifting of pre-cast concrete panels (exterior walls), and roofing had been completed before the Independent Oversight team’s onsite observations. The company superintendent and safety director led the Independent Oversight team on a tour of the site. Work at the time of the visit was performed by the construction company and various subcontractors, and included installation of steel wall studding, plumbing, and electrical work.

The superintendent indicated that he leads a daily job briefing. The contractor had no completed briefing forms available at the time of the visit.

The safety director joined the company in June 2013, but his name and contact information were not updated on the SSSP. The safety director is well qualified, and his work history includes Washington State OSHA. The superintendent had 25 years experience with the company and appeared very knowledgeable about the project.

The Independent Oversight team looked at the flowdown of contract requirements to subcontractors by reviewing a portion of a subcontract with the company’s electrical subcontractor for the Munro project.

Appendix 3, *General Inclusions*, section 8, of the subcontract indicated:

“On site safety meeting will be held as often as required by the contractor to ensure safety compliance with [Contractor] Safety Manual and Accident Prevention Plan, and any other S&H requirements required by the contract documents and the Main Contract”

and

“...subcontractor agrees to be bound by the safety rules and regulations set forth in [Contractor] Construction’s Safety Plan and the safety requirements specified in the contract documents.”

While the BPA contract safety requirements flow down to the subcontractor, they are not specifically delineated. Additionally, the contractor superintendent and safety director were not aware of the specific BPA safety clauses/requirements contained in the contract with the company. The contractor did not include the specific BPA safety clause language in the subcontract to ensure that subcontractors clearly understand BPA’s safety requirements imposed for each project. The BPA initiative to include the *Contractors Safety and Health Requirements for Prime and Subcontractors* document in the contract with each subcontractor could alleviate such shortcomings.

Observed overhead/elevated work was generally performed using manlifts and scissor lifts, reducing the hazards of using ladders and scaffolds for such work. The standard daily construction-related PPE (hardhats, vests, safety glasses, hearing protection, gloves, and boots) were worn throughout the worksite. A worker cutting steel wall studs used a face shield to protect the face against sparks generated during the cutting process. The Independent Oversight team did not observe work activities that required respiratory protection during this visit.

The superintendent indicated that he completed a hot work permit for the roofing work performed a few weeks earlier. However, the completed permit was off site with the roofing contractor and was unavailable for the Independent Oversight team’s review.

A cutting operation generated sparks inside the facility being built, but no hot work permit had been issued for this work. The area around the cutting appeared to be relatively free of combustible material at the time of the review. The company’s hot work procedure section 1.L. limits the need for a hot work permit for spark-producing equipment to work conducted in flammable storage areas. This practice may be inconsistent with NFPA 51B requirements and warrants a reevaluation.

The use of a PTSA form to conduct a daily job/task analysis for identification and control of hazards includes identification of work requiring hot work permits and other fire protection requirements. However, the superintendent indicated that the PTSA was not completed daily as required. As a result, the contractor missed opportunities to ensure that fire prevention and protection controls are in place for daily work tasks.

Roofing work was not performed during the Independent Oversight team’s visit to the Munro project due to low temperatures that adversely affected roofing material application. The SSSP indicated that a crane load hook would be used as an anchor point for fall protection systems for roofers. This procedure included in the SSSP was Operations Procedure: 05-1, *Procedures to Correctly Utilize the Load Hooks as a Fall Arrest Anchor Point*, dated March 12, 2013. This procedure was not included or invoked by the SSSP for the McNary Substation Upgrade Project (also contracted to the company, as discussed previously in this appendix) where this fall protection method was being used.

The SSSP requires that every worker and team member participate in a job-specific orientation before

their first day of work on the construction of the Munro Scheduling Center. However, the actual method for orienting new workers is to attend the daily job briefing on their first day of work. The SSSP also requires each subcontractor “before performing work onsite” to meet with the project superintendent and review the subcontract and subcontractor orientation checklist. The Independent Oversight team was informed that this orientation process (and completion of associated checklists) was not being performed, although subcontractors were included in the daily and periodic safety briefings.

The Munro SSSP contained much of the same information as the SSSP for the company contracted work at the McNary Maintenance Headquarters project. It also included some additions/changes for the safety controls needed at Munro, such as pre-cast concrete panel tilt-up work, emergency information, and working in close proximity to an existing microwave tower. The Independent Oversight team’s review of the SSSP indicated that the shortcomings and areas that were not sufficiently addressed in the SSSP for the McNary SSSP were also evident in the SSSP covering the Munro job.

PCS Antenna Replacement on a BPA Transmission Tower

An electrical company was contracted to install new or replace existing PCS antennas on BPA transmission facilities at 80 sites throughout Washington and Oregon. The work observed was replacement of antennas at the top of a 210 foot tall steel lattice tower on a BPA 500 kV transmission line near the Bonneville Dam. Since the transmission line on the tower was energized, only BPA authorized companies with qualified electrical linemen could climb the tower to perform the antenna replacement work. A contractor to a major wireless communications company performed electrical work on the ground to support the electrical/ communications equipment component upgrade at the ground level. The Independent Oversight team primarily observed electrical company work activities. The wireless communications company contractor was also observed to determine how the electrical company coordinated/interfaced with a collocated work activity that impacted their safety.

The Independent Oversight team observed the daily job briefings conducted by organizations. The electrical company’s briefing was given by the job foreman and covered the basics of tower climbing safety, including following their required 100 percent tie off while climbing, wearing standard PPE, securing tools and equipment from falling, and maintaining MAD from energized lines. The verbal and written job briefing did not discuss radio frequency radiation hazards from the PCS equipment, controlling (e.g., lockout/tagout) or eliminating the hazard, or how to communicate the controls that the wireless communications company contractor put in place for the radio frequency hazards prior to ascending the tower. The wireless communications company contractor verbal briefing mentioned that they would de-energize the antennas at the start of the work. The team did not observe any controls or communications between the two organizations on the de-energizing of the antennas before electrical company linemen ascending the tower. However, the Independent Oversight team verified with wireless communications company contractor that they in fact de-energized the antennas after the electrical company personnel started their ascent up the tower to start work. The coordination of these key safety controls was not formal or documented before starting work that involved radio frequency hazards. Independent Oversight noted a good practice in that the foreman pre-established routes to the local emergency care locations in the GPS navigation unit in the company vehicle.

The Independent Oversight team observed the electrical company foreman training a new-hire lineman on their 100 percent tie off fall protection equipment. The foreman indicated that the new-hire lineman had ten years of lineman experience, but this was the first day on the job. The new-hire lineman was the second lineman to climb the tower. The new-hire lineman climbed in a slow, but methodical manner, using a fall arrest system put in place by the first lineman up the tower. After a while, the first lineman informed the foreman that the second lineman (new hire) had possibly “passed out” for a short period or was feeling ill before making his way to the top of the tower. The new-hire lineman remained in a

stationary position until another lineman climbed the tower and found the new-hire lineman was capable of climbing down the tower. The new-hire lineman climbed down the tower without incident and started to provide ground support to the tower crew. After about half an hour, the foreman sent the new hire for a medical evaluation as a precaution. The contractor did not have a process for assessing the work and safety skills and fitness for duty of new hires before they perform work.

A qualified safety watcher was used to ensure that the climbing crew stayed outside the MAD.

The cold temperature affected the flow of hydraulic fluid from a tank on the lineman truck. An open flame torch was used to heat the tank (including placing the torch through expanded metal to be hands-free). At one point, liquid that appeared to be hydraulic fluid was flowing on the outside of the tank being heated, so the torch was replaced with a small heater. This use of a torch did not appear to fully consider the hazards and was not in keeping with the SSSP requirement that “Each employee is responsible for recognizing fire hazards, eliminating the fire hazards when possible.”

The SSSP for this job was not detailed or specific. The Independent Oversight team identified shortcomings in the SSSP that are similar to those discussed above for other SSSPs developed by the same contractor.

Lessons Learned from a Construction Company Accident

A construction company is a part of an Outsource Construction Services Contract Pool which performs transmission line related construction projects for the BPA. One of their employees was fatally injured on July 2013 while preparing to remove a jumper from a disconnect switch on the Bandon-Rogue No. 1 115 kV line. A level 1 accident investigation was conducted. The Independent Oversight team interviewed construction company representatives, including the President, Executive Vice President and General Counsel, Safety Director, and Business Development Vice President, about lessons learned from this accident. They considered the S&S clauses in the contract to be very broad and sufficient for them to understand their obligations. They indicated that the BPA APM was not a contractual requirement; however, BPA provided a copy of the APM to them on an annual basis. They also stated that the APM and other BPA requirements were in need of revision. For instance, one BPA document discusses ground to an anchor rod, which the construction company believes is not a recommended practice unless all ground rods used are bonded together, based upon input from the recognized grounding expert used by BPA. The construction company follows its own corporate programs and procedures, which are more stringent and comprehensive than the BPA requirements. They noted that for instances where BPA had specific requirements, such as clearance procedures, that the construction company followed the BPA process. When asked about the presence of BPA safety staff at the site, they indicated that the Safety Office staff was not at the site often. Regarding the field inspectors and contracted QA representatives, they thought it would be beneficial to clarify their roles. For instance, the Construction Company has noted that the field inspectors and QA representatives do not immediately share possible safety or QA concerns with the construction company, instead reporting them through a reporting system.

The construction company generally does not receive lessons learned on events from BPA, but receives information from the National Electrical Contractor Association and the International Brotherhood of Electrical Workers. They also receive safety memos occasionally from other utilities, but not from BPA. They share lessons learned within their company to staff and work crews through phone messages, weekly updates, and a monthly summary of lessons learned. The construction company indicated that they have quarterly safety meetings with some of their customers.

The construction company considers the SSSP to be an effective tool. In addition to the SSSP, after the daily job briefing, the crews do a task hazards analysis for the specific work planned for that day. They

typically have a full-time safety person on site, and this person has completed the OSHA 10-hour and 30-hour training classes, as well as the OSHA 20-hour leadership course. They do not have an industrial hygienist on staff, and rely upon a consultant to provide industrial hygiene services when needed.

The construction company provided information on the corrective actions that they have implemented since the July 30, 2013, fatal accident. One action was to emphasize a stop work policy. Construction company managers met with all superintendents and foremen to go over the accident and discuss expectations for stopping work when workers have safety concerns. Additionally, the construction company is developing grounding plans for typical and/or unique configurations, and will include a requirement in the SSSPs that a grounding plan be developed for each jobsite that requires temporary grounding during work activities. The construction company is also considering a review of the grounding plan by its own electrical engineer for adequate grounding protection as a measure to ensure that workers would not deviate from the expected grounding practice – a possible contributor to the fatality. In addition the construction company has strengthened its training program, including hiring a director of training. All new employees, as well as employees performing a new job, receive training for the job and are vetted by the training director. A grounding class and recertification for clearance holders are provided. Baseline knowledge of the subject matter is tested prior to the class and then checked after the class. The company also has a training system in place that offers numerous web-based courses.